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Photograph by V. Sella

K 2, THE HIMALAYAS

[The Second Highest Mountain in the World]

MOUNTAIN CLIMBING

By FRANCIS A. COLLINS

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ILLUSTRATED WITH PHOTOGRAPHS

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MOUNTAIN CLIMBING

MOUNTAIN CLIMBING

CHAPTER I

THE LURE OF THE MOUNTAINS

WHAT is the lure which every year draws perhaps a million people often far from their homes to face discomfort or danger that they may laboriously climb a few hundred or thousand feet? The fascination of danger attracts but few; many more are repelled by it. The explanation doubtless lies much deeper. The mountain climber enjoys the exhilaration gained from difficulties overcome. It is exercise in the open, and an ascent to freer and more inspiring air and scene. The impulse is perhaps an inheritance from out of the remote primitive life of the human race, which in another age found expression in fantastic forms of nature-worship.

Beyond all other sports, again, mountain

climbing is health giving. The most democratic of contests, it requires in its simpler forms only an equipment of stout shoes and sufficient determination. It may be taken in doses varied from day to day to suit the climber's strength and inclination. One man is satisfied to ramble among the foot-hills; another aspires to conquer Mount Everest; and both may be satisfied without violating the rules of the game.

The attitude of the world in general toward mountain climbing has undergone several curious changes. The ancients looked upon the mountains with indifference. The great peaks failed either to tempt the adventurer or to inspire the writer. Throughout the Middle Ages the mountains were regarded with fear and terror, so that for centuries no one ventured to climb even the lower peaks. Only in the last century have men lost their terror of the mountains, and found the courage and ambition to climb their sides.

The early mountain climbers risked their lives as a rule in a spirit of adventure. The ambition to be the first, or among the first, to scale the peaks which had always been con-

sidered inaccessible has caused thousands of climbers to face appalling risks and throw their lives in the balance. The price, in loss of life, paid in conquering the highest mountains of the world is amazingly high. The spirit of exploration and scientific investigation, again, has served to carry men perhaps further than the mere daredevil spirit of adventure, notably in the cases of de Saussure and John Tyndall.

Within the last few years, however, the attitude of the public mind toward the mountains has once more undergone an interesting transformation. To-day mountain climbing is not generally regarded as a daring and dangerous adventure, or an opportunity for exploration. For millions of people, the world over, it is merely one of the hardier forms of outdoor sports. Its appeal has thus been indefinitely extended. The inspiration and healthfulness of mountain climbing are brought within the reach of all. It has become one of the most democratic and least exclusive of pastimes.

The popularity to-day of mountain climbing the world over would have seemed incredible a generation ago. More than a quarter of a million mountain climbers are enrolled at pres-

ent in the Alpine clubs of Europe alone. This membership is not of the easy-chair variety. Virtually all do some climbing every season, while thousands regularly attempt the most difficult peaks. A generation ago the ascent of the Matterhorn or Mont Blanc attracted world-wide attention. To-day at least one hundred climbers reach the ultimate peaks of each of these mountains every season.

It is generally acknowledged that the lure of the Alps has made modern Switzerland what it is to-day. Before the conquest of Mont Blanc, Chamonix was merely a picturesque mountain village. Until Whymper scaled the Matterhorn, Zermatt was unknown. To-day these resorts are thriving cities, regularly attracting hundreds of thousands of visitors from all parts of the world. Hotels have been built with infinite trouble in this region at altitudes of over ten thousand feet. So great is the rush to the mountains that the overflow from the hotels has filled the private houses and even the peasants' huts and cow-barns. The churches and even the moving-picture theaters must be opened to shelter the enthusiastic mountain climber.

THE LURE OF THE MOUNTAINS

Mountain climbing has never been so popular in England as it is to-day. More than one hundred and fifty thousand climbers are enrolled in its Alpine clubs, whose members go in for serious mountain work at home and abroad. Although the British Isles can boast of no very high mountains, unlimited opportunities for rock climbing are offered. The rock work in Scotland is especially attractive. Definite tasks in rock climbing are required by the mountain-climbing clubs. The fact that these rocky hills are conveniently near makes it possible for tens of thousands of people to practise on difficult and dangerous rock work. All this is preliminary to more ambitious climbing in Switzerland, America, and other countries.

The interest in mountain climbing is moving steadily, like the course of an empire, westward. America exerts an irresistible appeal to mountain climbers in offering new worlds, or mountains, for him to conquer. There are innumerable virgin peaks in the great West which have yet to be explored. The mountain climber finds within easy reach many opportunities to gain fame and distinction by being

the first to scale such a mountain, and add to the world's knowledge of mountain geography, or perhaps hand down his name to posterity by naming some new peak.

Here is unlimited opportunity for the display of every phase of the mountaineering art; the most perilous rock and snow climbing may be found. With characteristic ingenuity and energy, America has set about organizing the sport on an elaborate scale. The science of mountain climbing is being systematically organized from the ground up. By railroad, automobile, mule team, or foot-path, tourists may now be carried to the hearts of the remote mountain ranges. The American system of national parks, with their tourist hotels, rest-rooms, and camps available for mountain climbers, compare favorably with any in the world. A number of Swiss mountain guides long practised in their art have been imported, and native guides are specially trained. The custom of providing woman guides to accompany ladies in difficult ascents is one of the innovations.

Efforts in mountain climbing are divided into two general classes, low and high climbing.

Many mountaineers fix the dividing line, or, rather, dividing elevation, separating the two classes at ten thousand feet. The mountains of the first class are typified by such familiar ranges as the White Mountains, the Adirondacks, and the ranges of Carolina. The problems of such mountain work appeal to the average summer visitor. No serious dangers are here presented. At such altitudes there is but slight change in the air conditions, and the rarefied atmosphere even of the highest mountains of these ranges is merely invigorating.

In climbing to an altitude of ten thousand feet or more an entirely different class of problems is encountered. The climber must, from long experience and training be capable of making a prolonged continuous effort, perhaps extending over many days. On passing an elevation of nearly two miles, atmospheric conditions, and the intense cold usually encountered, demand great powers of resistance. The mountains which rise to such an altitude usually present serious problems.

The ten-thousand-foot limit for dividing the two classes of mountain climbers is of course merely arbitrary and cannot be applied with-

out exception. Some of the most precarious rock climbing, in America as well as abroad, is often found on low hills. The winter climber, again, may find plenty of thrills on temporary snow-slopes at low altitudes. On the other hand, much comparatively easy climbing is found at altitudes greater than ten thousand feet.

It is the common boast of mountain climbers that they alone enjoy the rarest mountain scenery. As a reward of their struggles and disregard of dangers they may gaze down on inspiring mountain panoramas and dazzling snow-fields. The layman must be content with the photographs of such scenes that are brought back to him. The development of photography as applied to mountain work, however, has recently made a remarkable advance. Special apparatus has been developed to solve the problems of mountain photography. The telephoto lens now annihilates miles of country which heretofore had to be laboriously covered afoot. The modern mountain photograph, when taken by a skilful hand, is a work of art.

The beauty and inspiration enjoyed at high altitudes is thus brought to-day to the rocking-

chair mountaineer. The conquerors of Mont Blanc or the Matterhorn were eloquent of the wonders to be seen from these peaks, but the world was obliged to take their word for it. To-day the camera especially designed for mountain photography is as essentially a part of the equipment of the modern mountain climber as is his barometer. Even the motion-picture camera has been carried with infinite labor to the highest peaks. The glory and inspiration of mountain scenes may thus, in a measure, be shared by all. The mountain has been brought to Mohammed.

CHAPTER II

THE FIRST MOUNTAIN CLIMBERS

YOU may search in vain through the literature of classic times for an appreciation of mountain climbing. The most daring explorers of the period halted at the base of the mountains. The classic writers, who seem to have celebrated everything else under the sun, failed to catch the inspiration of the mountains. It is difficult to explain this astonishing indifference through so many centuries. Later, the ignorance and superstition of the Dark Ages peopled the mountains with monsters and evil spirits, which frightened away mountain climbers for a thousand years. It is only in the last century that the mysterious call of the mountains has fallen on other than deaf ears.

The distinction of being the first mountain climber is commonly ascribed to Noah, whose fame rests upon his performance in reaching

the summit of Mount Ararat. The extraordinary feat of achieving a high mountain-top with so large a party obviously cannot strictly be classified as a climb. The ark enjoyed miraculous luck in grounding on the mountain summit, and its method of ascent is unlikely to be repeated.

There are several passages in the Bible that have caught the beauty and inspiration of lofty places. Moses ascended Mount Sinai to receive the commandments. It was from the summit of Mount Pisgah that he viewed the promised land, while his last resting-place was on Mount Nebo. Christ ascended the Mount of Olives for meditation.

The first recorded ascent, apart from the Bible records, is attributed to Trajan, who climbed to the summit of Etna to see the sun rise. In view of the fact that the emperor was always surrounded by extravagant luxury, with countless slaves and attendants, the ascent was doubtless facilitated in every conceivable way. The same mountain had been climbed, however, by Empedocles, who gained immortality by leaping into its crater. Doubtless the first scientific observations in connection with

mountain climbing were those by the Greek geometrician who measured the height of Mount Olympus.

The history and literature of Rome contain but a few scattered references to mountain climbing. Hannibal crossed the Alps with his elephants and armies, although his route has never been definitely fixed. Spartacus camped on Mount Vesuvius, a modest feat for Spartan courage and daring. One of the letters of Seneca mentions an experience in mountain climbing, but there the record virtually ends. It seems remarkable that the Romans, who conquered the world, should have lacked the courage or ambition to climb their mountains to view their domains.

Throughout the Middle Ages the call of the mountains seems to have been completely silenced. The high altitudes were regarded with horror. The clergy often preached to be protected from dangers of the mountains, and prayers were offered for protection from their influence. It was not until 1188 that a daring monk of Christ Church, Canterbury, named John de Bremble, ventured into these dreaded regions. He succeeded in climbing to the top

of the Great St. Bernard, an amazing feat at that time, in view of the primitive methods of climbing. On reaching the summit he wrote a letter, still preserved, which is unique in mountain climbing literature. He expresses eloquently the attitude of even the educated people of his day toward the mountains.

"I have been on the Mount of Jove," he wrote, "on the one hand looking up to the heaven of the mountains, on the other shuddering at the hell of the valley, feeling myself so much nearer heaven that I was sure my prayer would be heard. 'Lord,' I said, 'restore me to my brethren, that I may tell them that they come not to this place of torment where the marble pavement of the stony ground is ice alone and you cannot set your foot safely. There is every facility for a fall to certain death. Let us henceforth devote our pen to the narrative of more worthy matters." Similar appreciation of the joys of mountain climbing is found in the records in the monasteries of the Alps.

For centuries the world was convinced that the mountains were the home of demons and monsters. Returning travelers described these

monstrosities in detail. One elaborate description of mountain climbing written in Latin was even illustrated profusely with pictures of snakes with human heads and fanciful combinations of men and beasts. King Peter III of Aragon, who climbed alone to the summit of Rochemelon about 1250, describes finding a lake inhabited by monsters. On throwing a stone into the water, according to the royal statement, "a horrible dragon appeared of enormous size which flew and darkened the air with its breath." The most imaginative of modern mountain climbers has much to learn from the narratives of the adventurers of the past.

The first mountain climber of the Middle Ages who had no terror of high places was the poet Petrarch. He climbed but a single mountain, Mount Ventoux in Provence, and that a comparatively low one, with an altitude of but 6432 feet. But the ascent, which he made alone, will forever remain unique in the history of mountain climbing. For the first time the beauty and inspiration of high places was recorded with sympathy. The ascent was made on April 26, 1335, yet to-day the descrip-

tion sounds curiously modern and familiar, certainly many centuries in advance of its time. Incidentally, the summit of Ventoux, which seemed so remote to the poet, is to-day occupied by a modern hotel.

"At first I was so affected by the unaccustomed spirit of the air," wrote Petrarch, "and by the free prospect that I stood as one stupefied. I looked back; clouds were beneath my feet. I turn my eyes to that Italian region to which my soul most inclines." He closes his meditations with this characteristic sentence: "How steadily must we labor to put under our feet, not a speck of elevated earth, but the elate appetites of our terrestrial impulses."

By a curious chance the year 1492 is probably the most important date in mountain climbing. The history of mountaineering may be said to date from this time. For many centuries the development of the art however was extremely slow. In the same year in which America was discovered occurred the first important authenticated ascent of which a detailed description has been preserved. Even judged by modern standards this particular feat is considered notable. It appears that

Charles VIII of France, "to gratify a whim," directed that Mont Aiguille near Grenoble, then called "Mont Inaccessible," should be ascended. The elevation is but seven thousand feet, but the sides are precipitous and require some stiff climbing. To-day the ascent is greatly simplified by an iron cable placed in position by the French Alpine Club.

The ascent was "planned like a battle," according to the official report. A large company succeeded in reaching the summit and remained there for a week. A solemn mass was heard, and the mountain was baptized, whereupon the party returned in safety. The leader, while atop the mountain, wrote an account of his exploit that will be read by mountain climbers five centuries later with sympathy.

"When I left the king," he wrote, "he charged me to cause an attempt to be made to see whether it was possible to climb the mountain, which was said to be inaccessible, which mountain I, by subtle means and engines, have found the means of climbing, thanks to God, and I have been here three days, and more than ten companions are with me." The feat was considered so incredible that an official investi-

gation was ordered by Parliament to establish the truth of the stories told by the climbers.

It was also toward the close of the fifteenth century that Leonardo da Vinci, with a party of friends, climbed several mountains and recorded his observations. As might have been expected, the great painter and scientist made many valuable and interesting observations. "I saw the sky above me quite dark," he writes, "and the sun as it fell on the mountains was far brighter here than in the plains below, because a smaller extent of atmosphere lay between the summit of the mountain and the sun." Da Vinci was doubtless the first of those explorers of mountains whose work has contributed to scientific knowledge.

Although the Swiss had long lived at the base of the Alps, they made no attempt to climb them until the beginning of the sixteenth century. One of the earliest of their ascents was achieved in 1536 by Johann Müller, who climbed the Stockhorn, a mountain of 7195 feet elevation. Müller's principal claim to fame among mountain climbers rests upon his detailed account of the climb, which was written in hexameter verse. He tells us that he

ate four meals on the way up and three meals on the way down, and the entire adventure lasted but sixteen hours. A short quotation of his account will suffice.

We then went up a ridge scarce three feet wide,
Thence over fields and pasture land until
Through rock and towering crag we climbed the hill,
And reached the Stockhorn top, when looking down
Eastward we see lakes, marshes and a town.
So when we found no beasts for all our pains
Then we decided to go down again.
Down long and narrow ridge we went,
Yet more convenient than the ascent
Was the return, more safe, more smoothly laid;
Butter and dairy produce here are made.

All mountain climbers will sympathize with Johann in his disappointment in not discovering the beasts or fabulous monsters he had been led to believe lived on the mountain-tops.

A notable figure among the early mountain climbers was Professor Conrad Gesner, who had climbed many mountains and wrote very entertainingly of them in the middle of the sixteenth century. Gesner really loved the moun-

tains and was a marvelously close observer. His work seems astonishingly modern, as though it had been written but yesterday rather than five centuries ago. "Nowhere else," he writes, "do you come on such a great variety of phenomena within a short space of time as in the mountains; to mention nothing else, you on a single day observe and pass through the four seasons of the year. Add to this that on the summit of the mountain ridges the whole firmament of heaven will lie open to your gaze, and you will observe the rising and setting of the sun, and you will remark that the sun sets more slowly and rises more quickly than is its wont."

Although the scientific knowledge of mountains was rapidly developed during this period, the belief that the upper slopes were inhabited by spirits and dragons long persisted. These fantastic ideas were not held by the peasants alone but by serious scientists of the day also. A German scientist named Johann Scheuchzer, who wrote in the middle of the sixteenth century upon the action of glaciers and contributed much valuable information to the world's knowledge of the subject, was a firm believer

in mountain dragons. In describing the action of glaciers he could write with intelligence, "Their progressive increase and the effects that follow it are not to be attributed to miracles, as is imagined by people who are ignorant of science, but to natural causes."

During his exploration of the mountains the same writer made a special study of the fabulous dragon stones, which were then much discussed. As a mountain climber who had visited the remote regions inhabited by dragons, he posed as an authority on the subject. He described them in detail. "A dragon stone," he wrote, "is a jewel cut out of a dragon's head when he is asleep. Should the dragon awake under the operation, it will die and the jewel disappear. So it is necessary to render the dragon drowsy by scattering about plenty of soporific herbs, or some recommended incantations."

No mountain climber of the period studied the subject of dragons more seriously or has left such vivid descriptions of them. He quotes at length, for instance, the experience of a mountaineer he had met named Linner, "whose word," we are assured, "can be trusted,

and who at the present time is still living. He solemnly deposed to me," the account continues, "that he encountered a terrible dragon black and gray in color which first coiled itself up and then raised itself upright. It had a head like a cat and no feet whatever."

All this was merely hearsay evidence at best, but later on Scheuchzer describes a demon which he saw with his own eyes. The writer's attention to details in describing his experience is delightful. "I was contemplating the beauty of the heavens by night," he writes, "when, lo and behold, I saw a bright and shining dragon issue from a large cave in the mountain, and fly about swiftly flapping its wings. It was very large, its tail was long, and its neck extended; it terminated in the serrated jaw of a serpent. While it was flying it threw out sparks just as the red-hot horseshoe does when hammered by a blacksmith. My first impression was that I saw a meteor, but after careful observation I recognized it was a dragon from the nature of its movements and the structure of its various limbs." And the writer proceeds to describe his experience in minute detail.

Despite these vagaries Scheuchzer praised mountain climbing as one of the most useful of pastimes, since it "contributed to the advancement of learning." His journals contain many apt comments on his adventures, which show that he had the true spirit of the mountaineer. "The climbing of mountains," he observed, "often takes one's breath away though it may be rendered less unpleasant by agreeable conversation." Every mountain climber again will agree with Scheuchzer's explanation of his failure to reach a certain mountain peak. "The failure," he explains, "was partially because of bodily fatigue and partly because of the distance to be traversed."

The old beliefs in the ancient terrors of the mountains died hard; they were common even among educated people much later than 1700. Professor Josias Simler of the University of Zurich, born in 1672, firmly believed that the Alps were infested with dragons. He met many people who reported that they had seen them at first hand, and the professor wrote of them in the same matter-of-fact way in which he discussed glaciers. As the result of his investigation he announced that "Dragons when

they breathe inhale not only the air but also birds that happen to be flying about. Some dragons have no wings, legs, or crests. There are dragons which have the faces of cats that breathe fire." In order to make his scientific treatise on dragons perfectly reliable, he obtained a number of special depositions from those who had seen them.

Simler seems to have been the first to write intelligently of the problems of snow climbing. Before his time the glaciers and snow covered slopes of mountains were full of terrors. Climbers were now learning how to avoid avalanches and select safe paths past such dangers. The beginning of modern snow craft is described by Simler in detail.

"To counteract the slipperiness of the ice," he wrote, "they firmly attach to their feet shoes resembling the shoes of horses with three spikes in them so that they may be able to stand firmly. In snow places they use spikes tipped with iron, by leaning on which they can climb steep slopes.

"These men tie ropes around their waists, to which those who follow are attached, and the leader sounds the path with a pole. The eyes

should be protected by some dark material, or by what they call glass spectacles, and the rest of the body should be well fortified against the cold by skins and thick garments."

It was at this period that general interest was aroused throughout Europe in glaciers. The expeditions of Pococke and Windham in 1741 to Chamonix, and the subsequent publication of their observations, were soon followed by many similar visits. The first snow-capped mountain was climbed three years later in 1744. The conquest of several of the great peaks of the Alps soon followed. The high peaks of the Pyrenees were climbed at about the same time as were those of the Caucasus.

The pioneer among mountain climbers in exploring snow peaks was a Frenchman, Jean André de Luc, whose exploits began in 1765. He was probably the first mountaineer to carry a thermometer to high altitudes, and to ascertain the temperature at which water boils in high places. As a result of his experience in making scientific observation he invented the hypsometer for ascertaining altitudes, and also substituted mercury for alcohol in the thermometer. A new era in mountain climbing

was opened by thus placing observations at high altitudes on a definite scientific basis.

Mountaineering in his day was of course in its infancy, and the ordinary difficulties of climbing were multiplied by the lack of proper guides. The French scientist has left an amusing account of his early struggles. In 1770 he planned an ascent in the Alps for scientific observation, but could find no guides, however inexperienced, to accompany him. He finally succeeded in engaging an "apprentice to a hunter," as he called him, for a companion. He chanced upon this man on the hillside busy making cheese, and despite lavish offers of money the "guide" refused to start on the expedition until he had finished.

When the two finally got under way it was soon apparent that the guide knew little of the mountain trails and cared even less. The two wandered aimlessly for some time, and finally came to the brink of a precipice, which effectually barred their progress. De Luc thereupon consoled himself by boiling water to ascertain the altitude. The experiment appeared so absurd to the guide that he broke into a violent fit of laughter, and so uncontrol-

lable was his mirth that he fell upon his employer's foot, whose ankle was sprained.

At this most opportune moment the guide remembered that his cows in the valley needed milking, and without a word he forsook his employer with the sprained ankle and started off down the mountain-side. Many hours later de Luc managed to crawl painfully back to civilization. His comment on the situation may well serve as a model of its kind for future generations of mountain climbers. "Perhaps," he wrote, "this action was only because the guide's bad reasoning got the better of his pity."

The distinction of being the first among the women who have climbed high mountains is generally credited to Madame Harsberg, who climbed the Montanvert in 1789. The same feat was performed by several women in 1800. The name of the first woman to ascend Mont Blanc, Marie Paradis, is more familiar. She was a peasant girl from Chamonix, born and raised in the shadow of the mountains, and doubtless the ascent had little terror for her. She was literally hauled to the top by guides in 1808. The glory of making the ascent has

suffered in the eyes of mountaineers, however, by her confession made some years later. "Thanks to the curiosity of the public," she wrote, "I have made a very nice profit out of it, and that was what I reckoned on when I made the ascent." The Empress Josephine made the ascent of Montanvert in 1810, with the aid of sixty-eight guides, whose assistance doubtless reduced her efforts to a minimum.

The outstanding achievement in mountain climbing of this period, and indeed of all history, was the crossing of the Alps in 1800 by the armies of Napoleon. The great Alpine passes were not traversed by roads or provided with shelters and rest stations as they are today. The ascents were scarcely less formidable than the slopes of the highest peaks. Great snow-slopes must be negotiated and blinding storms faced despite the extreme cold. In ordinary climbing a small party faces these difficulties burdened only with simple equipment and provisions to meet its needs for but a few hours.

Napoleon's climbing party was numbered by tens of thousands, and they must carry with them over these high passes not only food for

many days but the cannon, ammunition, and other ponderous equipment of war. Napoleon attacked the problems of mountain climbing with characteristic energy. In a few days he succeeded in mastering the art. His methods may serve in many respects as a model. It was a fortunate chance that made it necessary for the great genius of organization to become a mountaineer.

The four great passes of the Alps were used, Napoleon himself, with the greater part of his army, choosing the Great St. Bernard. The trails negotiated by this army with his equipment were but two or three feet in width and covered with deep snow, often bordered by great precipices, and continually exposed to avalanches. More than thirty-five miles of such mountain trails must be climbed. The ascent to Mont Blanc or the Matterhorn is at most the work of a day or two. Napoleon's army crossed the Alps in thirteen days with trifling losses.

Napoleon anticipated every difficulty. The trails over the several passes had been carefully surveyed. Alpine huts and stations for supplying food had been established along the

route. Even saddler and blacksmith's shops had been installed in remote mountain fastnesses with the necessary equipment and supplies. The country had been ransacked for horses, mules, wagons, and snow-sleds, and these were ready waiting at the entrance of the passes. When the trails became too steep and narrow for vehicles or even for mules, provision had been made for carrying the guns by a more primitive method. Trees were felled, the trunks hollowed out, and the cannon tied on them. The logs were then drawn by soldiers in harness.

The main force assembled at the entrance to the Great St. Bernard Pass comprised thirty-five thousand infantry and artillery and five thousand cavalry. Smaller forces were sent to guard the other passes. It was planned to cross the Alps into Italy with sixty-five thousand men and hold all the passes in the mean time. Every eventuality was anticipated. In case of failure Napoleon still had several lines of retreat left open. The main force began the ascent from St.-Pierre on May 15. The start was made promptly at 1 A. M. Napoleon had not failed to study the effects of weather

and the hour of the day on snow-slopes and arranged his schedule accordingly.

Never probably have mountain climbers set out so heavily laden. The men carried equal weights of food and ammunition, since both were essential. The first stage of the climb covered the distance to the St. Bernard Hospice and was accomplished according to schedule in eight hours. Here a welcome surprise awaited the tired soldiers. Napoleon long in advance had arranged with the monks to supply the army with food, so that unprecedented qualities of supplies necessary for the army had already been laboriously carried up the mountain and prepared. The St. Bernard Hospice never accepts pay for its hospitality, but Napoleon was lavish in his presents. Day by day as the long files of soldiers fought their way up through the snow to the monastery each soldier was supplied with bread, cheese, and wine.

Every inhabitant of the region who could assist had been engaged, often at amazing wages. The great problem was to get the cannon over the pass, and Napoleon offered a prize of one thousand francs, a fortune at the

time, for every gun carried across. So steep were the slopes in many places that one hundred men must be harnessed to a single cannon. Many lives were lost when the heavy guns slipped on dangerous slopes and dragged over the precipices the men harnessed to them. The difficulties were at times apparently baffling, and the men found it impossible to proceed. It was then that Napoleon hit upon the famous expedient of bringing up the flags, drums, and trumpeters and giving the signal for an advance as on the battle-field.

Even after the crest of the pass had been reached and passed, the effort seemed to have been in vain, for a fort blocked the narrow pass. Napoleon on hearing this report hurried forward. He crossed the Alps partly on mule-back and partly on foot with a single Swiss guide. On reaching the fort he too decided that it would be suicidal to march along the narrow trail under the enemy guns, but his ingenuity was equal to the occasion. He at once planned a new trail, which was completed in a few hours of desperate work, and his army passed around the fort protected from its fire. The commander of the fort had sent word

ahead that the army had passed but that by no chance could a single cannon be carried over. Napoleon and his army with its equipment intact reached Piedmont with sixty-five thousand men in thirteen days after beginning the ascent of the Alps. Had Napoleon descended from the skies the enemy could scarcely have been more surprised.

The most fearless mountain climbers are not aways recruited from the Alpine clubs or the ranks of the professional guides. The spirit of adventure will carry a man very far, and the guide, whose familiarity with such dangers often breeds contempt, is rarely daunted. Many of the most famous ascents, however, have been made wholly in the interest of science. Such feats are the more remarkable since the scientist is likely to be unaccustomed to strenuous and daring outdoor exercise. The man who leaves his library or laboratory to climb high or dangerous mountains might seem to be seriously handicapped, but again and again he proves himself a dangerous rival of the seasoned guide.

A famous example was the ascent of the Weisshorn by Professor John Tyndall in 1861.

The peak presented unusual difficulties. The famous scientist announced his intention of exploring its high slopes and engaged guides to make a special study of its precipitous sides. Accompanied by two guides, Professor Tyndall camped the first night at a considerable altitude. The party was astir at two o'clock in the morning and in marching order long before daylight. The start was made at three thirty.

The trail selected crossed a particularly treacherous field of snow and ice. This section had been carefully reconnoitered by the guides in advance, and in the more difficult places steps had been cut. In the high altitudes every step must first be cut away in the icy slopes. The path narrowed until it traversed the top of a wall not six inches in width, which fell away on either side into deep precipices. The peak proved to be extremely elusive. After a steady climb of five hours the top of the mountain appeared to be actually receding, and the distance separating the climbers from their goal was greater than ever. The guides were greatly impressed not only by the courage of the great scientist who

led them but by his unexpected agility in jumping from point to point.

The account of the ascent, as afterward written by Professor Tyndall, is a rare combination of authoritative scientific record and the story of much thrilling adventure. On finally scaling a particularly high peak it was discovered that the summit still lay far beyond. The courage of the scientist was equal to the disappointment. In the final climb it was necessary in Tyndall's words "to scale a large prism of granite from which a knife edge of pure snow ran up to a little point." The last problem, which might well have daunted a less courageous spirit, was finally solved, and the party with their scientific instruments intact stood upon an elevation 14,831 feet in height. The victory was celebrated by fastening a red flag to an ice-pick handle and planting it firmly in the snow when the party turned homeward. Later this patch of red was clearly seen by means of telescopes from the valley below.

CHAPTER III

SNOWCRAFT

IN mountain climbing at high altitudes the trails inevitably traverse fields of snow and ice, tilted at more or less precarious angles, commonly called slopes. Above the snow-line all approaches to the mountains, as well as the peaks themselves, demand more or less skill in snowcraft. If the angles of the slopes be moderate and the footing sure, the snow alone commonly affords easy climbing. They are, of course, beset by serious dangers. The unbroken surface of the snow may conceal a deep crevasse, or the snow may suddenly shift its position, forming dangerous slides and avalanches. The steeper slopes may often be negotiated only by laborious step cutting. Snow climbing again often demands great skill in roping. Long experience is required to judge if snow will bear the weight of the climbers or remain in position on steep ascents. Snowcraft has become a fine art.

The supporting power of snow depends largely, of course, upon its foundation. Snow lying on rocks is often "rotten," in the guide's phrase, unless it be very deep. The snow which has fallen on an original covering of snow, on the other hand, may usually be depended upon. The most treacherous snow slopes are those having, at whatever depth, a foundation of ice. Snow cannot lie upon ice at a steep angle, or if it holds its position an incautious step may set it in motion. As a rule snow slopes seldom exceed forty degrees, and a greater angle should warn climbers to keep off. The angle of the slope, however, is very deceptive among the high hills in the blinding glare of the sun.

It is often found safer to ascend or descend snow slopes directly rather than to cut across them at an oblique angle. Curiously, a track across such fields at an angle other than ninety degrees is at times likely to set it in motion. A steep snow slope is extremely dangerous if it be in bad condition. An error in estimating its strength or the nature of its underlying support may set a mass of snow in motion which will start an avalanche. An experi-

enced eye, it will be seen, is required to judge if doubtful snow may be depended upon. It is much easier to go wrong in snow climbing than in ascending rocky trails at far more precarious angles.

The supporting power of snow again is largely dependent upon the weather. Newly fallen snow as a rule is treacherous, while even a day or two of cold weather may transform a very tricky surface into a dependable trail. The hour of the day is also a very important factor. Most snow slopes are usually hard and safe in the early hours of the morning. By mid-morning, however, they become soft and dangerous. Any change in the weather is watched with the most anxious attention. The supporting power of snow slopes over wide areas may be seriously affected in a surprisingly short time. This curious treachery of the snow may quickly render an ordinarily safe and easy trail extremely perilous. It is not uncommon for great areas of snow to be so changed in a few hours that a party of climbers may have great difficulty in retracing their steps and may find themselves cut off at a remote altitude.

Among the dangers that lurk in high places the avalanche is perhaps the most familiar and awesome. Stories of great fields of snow sweeping everything before them are among the most vivid recollections from our early lessons in geography. The onslaught of an avalanche is so sudden and its power so irresistible that nothing in its path escapes. The science of snowcraft, nevertheless, by matching men's wits against them, has greatly reduced this danger.

From years of observation it has been found that the snow avalanche is controlled by definite laws, so that an experienced mountaineer can determine the paths they will take. Countless details in the appearance of the snow which mean nothing to the uninitiated serve to guide the experienced mountaineer past every danger.

The beds of snow which accumulate on ledges of rock present an especially difficult problem. The sun in the middle of the day may thaw them sufficiently to loosen their hold. A change of a few degrees in temperature may set them in motion. So delicately poised are some of the snow masses that the vibration of

a loud noise, such as a falling rock, may loosen them. Destructive avalanches have started by the most trifling accidents. The experienced mountaineer learns to judge snow conditions with marvelous accuracy and becomes so confident of his opinion that he will risk his life on his judgment.

The position of the snow-field and contour of the mountain indicate to the old mountaineer the course an avalanche will take when loosened from its base. A certain route through mountain valleys or across ice-fields that cross the paths of avalanches may be highly dangerous at one day or hour and perfectly safe at another.

The great snow avalanches usually occur early in the year when the snow for various reasons is in bad condition. A fresh fall of snow is regarded with suspicion, for it is often the forerunner of a devastating on-sweep. As a rule the slides occur on steep slopes, but once set in motion they travel far and wide. The snow fallen on rocky ledges is especially likely to be dislodged by even a slight thaw, when great masses will slip off bodily. The days when the snow is in a bad condition and likely

to be set in motion are easily recognized by the experienced mountaineer, and his plans are laid accordingly. At such times it is dangerous to traverse the most familiar trails which at any other time of the year are perfectly safe.

The world is indebted to mountain climbers for immensely valuable information concerning glaciers. Observations have given us definite knowledge of their formation and movements. Until comparatively recent years it was not known that glaciers moved, nor how they were formed, nor how they acted under various conditions. The glaciers are especially interesting and impressive in the region of Chamonix, and it was here that Tyndall made his studies that have revealed their secrets.

The glacier is simply a river of snow which with infinite deliberation drains the vast snowfields of the mountains. Above the snow-line the snows are literally eternal. One year's snows are therefore added to another, each year wrapping a new covering about the deposits of other years. If these deposits remained rigidly in place they would mount rap-

Photograph by V. Sella

MT. SINIOLCHUM IN THE HIMALAYAS

[The Most Beautiful Snow Mountain in the World]

A PERILOUS SNOW SLOPE IN THE ALPS

CROSSING A CREVASS BY A SNOW BRIDGE

idly in height year by year, and in the course of centuries would measure miles in thickness. The highest mountains would be buried beneath great shapeless domes of snow and ice.

At its source a glacier is merely a vast expanse of snow. Gradually its weight exerts sufficient pressure to set it in motion and it begins, however slowly, to flow downward. In mountain regions the snow, following the line of least resistance, flows down the mountain's slopes and gathers in the ravines and valleys, forming long streams. When a glacier forms over a level surface it spreads out to surprising dimensions. On reaching the end of a narrow valley or gorge the glacier spreads out fanwise. It is usually thickest near the center.

As the snow deposits are piled up to a depth of hundreds of feet, the lower layers become slowly solidified and are gradually transformed in the lapse of years into solid ice. In the course of centuries the glacier reaches incredible size. Some of the glaciers of Greenland have a thickness of more than five thousand feet, or about a mile. There is enough ice in a single glacier to build an entire city like New

York or London. Sooner or later, of course, the snow and ice must find their way back to the sea. When the end of the glacier dips into the water it breaks off, forming great icebergs. Inland, the ice flowing below the snow-lines gradually melts, forming lakes or the sources of great rivers. If the waste of ice becomes greater than the supply, the end of the glacier will advance or retreat in direct relation to the severity of the winter and the heat of the summer. In mountain regions the glaciers often move in cycles of from thirty-five to fifty years.

It is a very simple matter to prove that glaciers are in motion and to measure their exact progress. The common plan is to drive a series of stakes in the ice, forming a straight line directly across their floor at right angles to the movement. It will soon be found that the stakes at the center are advancing, and the once straight line becomes sharply bowed. The rate of progress is not uniform, since it is accelerated by the heat and retarded by the cold.

It is generally supposed that the progress is exceedingly deliberate, perhaps but a few

inches a year, and this pace is often employed as a standard of humorous comparison. As a matter of scientific fact, it has been found that the Swiss glaciers move from one to four feet a day. In Alaska the average is about seven feet, while in Greenland they maintain a comparatively rapid pace, varying from fifty to sixty feet a day.

Mountain climbers are not concerned, however, with this movement, but they must watch with the most anxious attention the behavior of the ice river in its uneven channel. Despite its great mass and weight, the ice is extremely brittle. The crevasse, so much dreaded by climbers, may be formed without warning by a trivial accident. The ice is split to great depths, for instance, by the strain of the central parts dragging away from the sides of the channel. Tension caused by a sudden bend in the glacier, or from passing over inequalities in the bed hundreds of feet below the surface, are frequent causes of such breaks. Although the glacier may move but a few inches in a day, a crevasse hundreds of feet in depth may be formed in a few seconds.

It has been found that the crevasse usually

develops at right angles to the strain and may produce deep fissures in the ice which intersect one another and extend in several directions. The upper regions of the glaciers are especially treacherous, since they usually appear smooth and unbroken beneath the snows. During the summer months when little snow falls the body of the glacier is more or less worn away, and gaping crevasses of great depth are formed. The safety of the climber therefore depends largely upon his skill in reading the face of the glacier, and determining from the formations of its channel the position and direction the crevasse will take.

In traversing these great expanses of ice the mountain climber often faces great dangers, but he is rewarded by marvelous ice scenery. The brilliancy of these great masses of ice under the sunlight has no rival in the world. The coloring of the ice, which presents beautiful shades of blue and green, is exquisite. Here again the snow lies in perfect crystals, so that whether seen in mass or in detail the glaciers are a never failing source of interest.

An inviting field of snow may conceal cre-

vasses. Whether they lie open or are hidden by deep snow, such chasms are to be dreaded. Crevasses are found in glaciers or masses of ice where they pass over an uneven bed, and frequently they are of great depth. They usually occur near the point where the final slope of the mountains rises from the snow-fields or glaciers. Glaciers are usually open in the lower regions, while above the snow-line they are frequently concealed by snow and ice. The accumulation of winter snows often forms an arch above the chasms, while new snowfalls conceal every trace of their existence. A climber traversing an unbroken field of snow may suddenly without a moment's warning disappear in a crevasse so deep that every trace of him is for ever lost.

A seasoned mountaineer is much too clever to be caught in this way. He reads signs in the contour of the ice-fields from afar. On coming across the open crevasse he can trace the ramifications of its fissures, even the hidden ones, for long distances. If he be suspicious of a field of newly fallen snow, he makes sounding with a pole or ice-ax before venturing ahead. Along the familiar trails the

presence of a crevasse as a rule has been charted and may be located under a new covering of snow.

From long experience mountain climbers also learn in some mysterious way to detect from the appearance of the snow or ice covering if there be an open space hidden beneath it. Skilful mountaineers can detect a treacherous bit of snow by looking at it from various angles; once their suspicions are aroused, they approach with extreme caution. It is something of a trick to test the snow by plunging with a long stick. If the stick sinks gradually into the snow, meeting the proper resistance, the surface will support the weight of a man, and the party proceeds. It often happens that the pole pierces the shell of snow at a touch and plunges downward. The party thereupon gives the suspicious area a wide berth.

Crevasses, although often very narrow, are usually too wide to be jumped. They may often be crossed by means of snow bridges. Such support is obviously very precarious and must be very thoroughly tested in advance. The great safeguard in passing crevasses is the climber's rope. When several are roped

together, forming a line of some length, the crevasse loses its terrors. The opening of the crevasse is usually but a few feet in width, and if the line of climbers be extended, only one of the party at a time is likely to break through. He may feel very uncomfortable dangling above an abyss but is reasonably sure of regaining solid ground.

The mountaineer often finds himself beset by a twofold danger, that from above as well as that from below him. He must travel for hours below overhanging cornices of ice and snow or fringes of giant icicles. It is not enough to watch every foot of the trail. The mountains above must be watched with an experienced eye. Falling ice and snow give scant warning of their movement, and among the mountains, as on the plains below, the velocity of falling bodies increases with the distance.

The places where ice and snow may fall is easier to determine than in the case of loosened rock. A rock may break away at any point on the broad face of the mountains, but the snow and ice are in a way more stable. Ice is usually detached from the broken parts of glaciers and from overhanging cornices of

snow ridges. The great icicles which often menace the mountaineer are formed on the steep faces of rocks or overhanging cliffs. Their presence can usually be detected by the débris below them. On discovering a mass of newly fallen snow and ice on the trail, or near it, a new path is quickly chosen.

The icicles or snow ledges form and reach a condition of equilibrium very slowly, but an experienced ice and snow climber can foretell their movement with uncanny skill. The great icicles which form on steep rock faces, for instance, will not fall on extremely cold and stormy days. They are in danger of falling just after the warm hours of the day. The débris formed of broken icicles furthermore penetrates the snow and seldom moves far from a point directly below the point of breaking. This habit simplifies the work of the guide, who can thus tell at a glance the perpendicular path they have traversed.

The falls of ice are much more common in the autumn than in the spring season, when they might naturally be expected to follow the early thaws. By autumn the winter snows have completely melted away, and the loss of

this support causes the break. A frequent source of danger is the hanging glacier which forms high up on steep slopes. Great masses of ice called "snouts" are formed at the outer edges, and, as they project from the rock, break at intervals and discharge over the rock faces. They often fall from great heights, and often from a concealed position. It is an imperative rule in mountaineering to give a wide berth to any such débris.

The descent across a rock face is generally considered more dangerous than the climb. In snow work the case is different. One of the most exhilarating experiences in mountain climbing is the glissade down steep mountain-sides. It is merely another name for sliding or sledding without a sled. It frequently happens that a mountain-side will be covered with ice or hard snow, which makes ideal sledding. When this surface is covered with several inches of newly fallen snow such slopes are particularly inviting. The snow offers enough resistance to check one's progress and make the descent comparatively safe.

The climber sits down, feet first, with his ax held behind him to serve as a rudder and a

brake. As a rule glissading is done by several members of a party securely roped together. In case one loses control of his movements he can thus be slowed down by the others. If the slope is not too steep and the foot of the slide ends in a snow-bank or on solid ice the glissade is considered fairly safe. A descent of hundreds of feet which took hours to climb can thus often be accomplished in a few seconds. Many tragic accidents have occurred, however, through misjudgment either of the angle of the snow slope or of the landing-place at the end. A snow slope may overhang a precipice at the end of a swift descent, and the climber may thus be hurled into space.

The cutting of footholds in climbing ice and snow slopes plays an important part in climbing. Much depends, of course, on the quality and condition of the snow underfoot. If the snow be very soft, it may be impossible to gain a footing, and a new route must be found. When the snow is very fine and powdery, again, the walking may be difficult, even impossible.

The best snow surface for climbing is that on which secure footing can be obtained by

merely kicking footholds. It should be just soft enough to allow the heavy climbing boots to secure a safe resting-place. If the climber must stop to kick vigorously before he can get a foothold, or, on the other hand, if the snow slips beneath him, the going is likely to be difficult.

In cutting footholds on steep slopes, the step should, if possible, be large enough to accommodate both feet at the same time. If the slope be very steep the foothold should be deep enough at intervals to allow the entire foot to be firmly planted in position. This enables the climber to transfer his weight to his heels from time to time, and thus rest the muscles that have been used in raising himself by his toes. Skill in snow climbing is only acquired by long practice. It cannot be learned through a correspondence school.

It is generally agreed that the most beautiful snow mountain in the world is Siniolchum in the Himalayas. It rises to an altitude of 22,570 feet, but its beauty depends chiefly upon its superb outlines. Few Europeans have ever seen Siniolchum, for it lies in a remote region north of Darjiling. Even the expeditions that

have penetrated this region have rarely reached a point where the full beauty of the mountain may be enjoyed and incidentally photographed. The party led by the Duke of the Abruzzi was especially fortunate in reaching such a position and photographing Siniolchum at its best. The photograph facing page 40 which was taken by Vittorio Sella, is generally considered the finest snow picture of its kind ever made.

Siniolchum is as steep as the Matterhorn and about five thousand feet higher, thus lending itself admirably to snow effects. It is built up of great granite crags, which throw the broad snow-fields into bold relief. The entire face of the mountain is covered with a magnificent fretwork of snow to its utmost peak four miles above. No climber has so far had the hardihood to attempt this ascent.

CHAPTER IV

ROCK CLIMBING

ROCK climbing is a hand-to-hand struggle that calls upon every resource of the mountaineer. The trapeze performer often has a much easier time of it. In going up the perpendicular side of a mountain the climber faces an even livelier danger than the steeplejack or so-called human fly who scales the walls of high buildings. The cornice at the twentieth floor of a building will at least "stay put," as will the church steeple, while the mountain may be crumbling.

The skill of the rock climber lies largely in his judgment in selecting handholds and footholds in untried rock. The climber must be able to judge the strength of rock at a glance, for his life may depend upon his decision at every step. The crag or projection must prove firm enough to support his weight, or his career as a climber may come to a sudden end.

He may be obliged to trust his life to a loosened rock. It is only from long experience that a rock climber gains this skill.

The rock climber, again, must be a gymnast in perfect training. It is one thing to chin a bar in the gymnasium or draw oneself to a trapeze swing. The rock climber must be able to raise himself by his own sheer exertion again and again, while perhaps hanging precariously over an abyss, his hands meanwhile perhaps grasping a broken edge of rock. A rock-hold above him may promise support for a time but threaten to fall by a sudden transfer of weight. These are perhaps extreme problems, but the life of a daring rock climber in passing up or down precipices depends upon his ability to retain his footing under all conditions. Great rock climbers are said to be born rather than made. As a rule a mountain climber is not skilful in both ice and snow work, and those who excel in one are not equally proficient in the other.

Many mountain climbers train themselves by long and arduous work for rock climbing. The first step is usually to climb a convenient stone wall. Any rough surface somewhat

higher than one's head will answer the purpose for the first attempts. The climber learns to judge the value of footholds and handholds upon such a surface, while remaining conveniently near the ground in case he makes a mistake in judgment. In climbing up or down he must of course face the wall or the mountain-side. He must teach himself to distribute his weight to the best advantage on hand or foot, and when possible relieve the strain by gripping a projection with his knees as well as arms.

In rock work the arms feel the strain before the feet, and the rock climber must learn to shift his weight so that no one set of muscles will give out before another. Vigorous gymnastic training will be found of great assistance in developing the muscles for such work. It will be found that virtually every muscle of the body is brought into play in such climbing. It is important in rock climbing to keep a reserve of strength. A slip at any moment may make it necessary for the climber to hang on literally for dear life, and he must then exert every effort to keep his position. If he be tired, or if any one set of muscles be too fatigued to re-

spond to the call made upon them, he may have a bad fall.

According to the geologists, all rocky mountains are slowly but inevitably falling to pieces. Mountain climbers experienced in rock work have discovered this fact for themselves. The process of disintegration is especially rapid above the snow-line. Here the crevices of the rocks are constantly penetrated by moisture, and the alternate freezing and thawing in time wear away the hardest surface. Without going deeply into the geology of the problem, the climber soon learns that rock faces are more or less continually swept by falling rock and hence are dangerous.

It is surprising to find that falling rock may be a less dangerous missile than falling ice or even falling snow. Rock climbing has been reduced to an exact science, and there are today surprisingly few accidents from this cause. The rocky face of a steep mountain reveals many secrets. The direction of the dip of the rock strata shows at a glance if the face be dangerous and likely to shower down stones upon those beneath. When rocks fall in any number they are likely to form furrows on the

face of the mountain, which are clearly visible often for great distances, and give sufficient warning. Unlike snow and ice, the fallen rock cannot melt away but leaves permanent débris at the foot of a mountain for the edification of mountaineers in years to come. When rocks fall upon snow slopes they cut furrows both wide and deep, so that the snow scars are visible for miles.

Stone falls usually occur in certain kinds of weather and can often be anticipated with surprising accuracy. The upper faces of some mountains, again, may be safe for climbing, while their base is frequently swept by heavy stone falls. The mixture of snow and ice with stone forms dangerous mud avalanches, but these are rare and follow well recognized tracks which may be avoided. Again, a falling stone makes a great commotion about its progress, often announcing its coming in advance, so that an alert climber can usually dodge them. The menace of falling stones is far more common in the Himalayas than in the Alps. In climbing new peaks the surface indications of stone falls must be watched with the most anxious attention.

The mainstay of the rock climber, to borrow a metaphor, is his rope. The system usually followed of securely roping the climbers is an excellent precaution for all but the first man in the line making the ascent. It is common to rope three or four men together, spacing them from fifteen to twenty feet apart. So long as they keep the rope tight between them, which means that all move at exactly the same rate, the rope will avail. In other words, if one of the men slip and fall the chances are that the other two or three, thus roped together, will be able to bring him up with a jerk, and enable him to regain his footing.

In climbing a smooth rock surface it is often extremely difficult for the men to retain their proper spacing. If the rope between any two of the party sags, and one of the men on the loose rope falls, the consequent jerk is likely to carry all the men from their positions. Should the first man in the line fall, the jerk on the rope is likely to loosen the hold of each of the men in line. If the ascent be gradual, the men are likely to be more firmly placed and enabled to withstand the sudden jerk resulting from the fall of any one of the party. The

photographs of perpendicular ascents brought back by rock climbers prove that this branch of the climb is often extra hazardous.

One of the tricks of rock climbing is to throw the rope connecting the climbers over some projection above them and to scale the mountain by going up the face of the rock hand over hand. There is a lively danger, however, of roping rotten rock, or of starting loose stones that may fall on those below. In the more daring ascents, when the rock face approaches the perpendicular, a single mistake in judging a handhold or a foothold may thus endanger the lives of the entire party. The skill, courage, and endurance of seasoned rock climbers is astonishing. It is only by hours of such climbing under the most perilous conditions that many ascents are possible.

Even with the aid of ropes, one of the most difficult feats in rock climbing, is to make a horizontal traverse across steep and rugged rock faces. Both ends of the roped line must constantly maintain a very firm position. Neither end of the line can gain assistance from the rope, and a single slip by any of the party threatens to drag them all down. The

success of such rope work depends of course on the perfect coöperation of the entire party.

An especially daring feat in rock climbing is the formation of a pyramid of men three high, in the gymnast's phrase, to reach an upper ledge of rock. In some cases three men will mount on each other's shoulders until the uppermost has reached a footing, when the others are pulled up. In such cases the lowest man may stand meanwhile in a precarious foothold cut in the ice. After bad weather the rock faces are often covered with a veneer of ice, which lends a new danger to perhaps the most perilous form of mountain climbing.

The mountain climber must inevitably become something of a geologist. In many weary climbs over every form of mountain he gains an intimate first-hand knowledge of the science. If this knowledge be supplemented by scientific training, the mountain climber may have a course of instruction in geology which in some respects no merely academic training may rival. The least observant climber must perforce come to be on intimate terms with the mountains he climbs.

The innumerable forms that mountains take

have much in common. They have all been formed either by uplift, land sculpture, or eruption, or by a combination of these forces. Most mountains of all continents have been formed by the uplift of the earth's surface. The earth's crust has many folds or wrinkles, which take on an endless variety of forms. According to the contraction theory, the cooling of the earth proceeds more rapidly in the interior of the globe than near its surface. This causes a more rapid contraction of the interior, and the crust, trying to make itself smaller in order to fit the restricted space, becomes wrinkled and corrugated. These wrinkles are located near the points of weakness. To the human eye the slightest wrinkle of the earth's surface appears an impressive mountain.

Any elevation which rises above the sea is the target for a number of powerful forces that slowly but surely wear it away. The power of erosion, the effects of wind, water, and changes of temperature, slowly cut away earth and rock, however hard it may be. First the soft parts are cut away; then the hardier portions are slowly reduced. If this

action be carried on long enough the original form of the mountain is gradually modified and then transformed and in the end leveled off. As a result mountains have an endless variety of shapes.

The Alps, despite their great height and mass, are in reality but the knobs or stump of the original mountains that once stood in their place. The original mountain group towered high above the group we know to-day. The great Matterhorn itself is but the stony skeleton, a mere tooth of a stupendous mountain whose bulk once surrounded and towered high above its peaks.

To take another instance and one nearer home, the Catskill Mountains of New York once contained coal-mines, but this stratum of coal lay at a point high above the present mountain summits. Through countless centuries the erosion of rain and wind gradually wore away these great mountains, dissolved the strata of coal, and slowly washed them down the Hudson River with other débris, mostly in the form of sand, and, depositing it, formed much of the present State of New Jersey. By a similar process the mountain ranges the

world over are being gradually worn away.

The mountains serve many useful purposes quite apart from offering opportunities for Alpine clubs. They are the great collectors and distributors of water that make vegetation possible, and therefore sustain life on this planet. The winds cross the mountains charged with moisture that is precipitated in the form of water or snow; the mountains intercept the course of the winds and abstract the moisture. The country on the windward side will therefore be well watered, while the regions on the leeward side will be dry and arid. Above a certain height, of course, the moisture falls in the form of snow. This is especially seen in ranges that rise to great altitudes and form barriers, like the Himalayas.

A range of snow-clad mountains rising to a considerable height and unbroken by passes or valleys makes a much more effective barrier between the plains than the widest ocean. The only exception is in the case of mountains cut by valleys below the snow-line.

As a rule the atmosphere on a mountain-side falls one degree for every three hundred feet of the ascent. The rate of precipitation, as

any observing mountaineer will tell you, increases as one ascends. Near the top the vegetation at first gradually thins, then ends entirely, leaving the rocky peaks absolutely bare. The line separating the eternal snow from vegetation can be traced from great distances. The limit of vegetation, of course, is reached earlier on mountain sides in cold than in warm climates.

The mountains play curious tricks with the winds, and the experienced climber becomes very skilful in anticipating and dodging gales and air currents. At high altitudes the winds may beat upon the mountain passes with incredible fury. The mountaineer not only learns to recognize the signs of their approach but can tell how they will react against the irregular slopes of the mountains. Some mountain formations act as tunnels, accelerating the speed of the air currents, while protection may be afforded by following other trails.

It often happens, for instance, that a high wind beating upon a perpendicular surface is thrown back and reacts at unexpected angles. The center of pressure is not as a rule near the surface of the mountain-side in this case,

but several feet back from it. There are therefore unexpected "dead" spaces during a gale where a mountain climber may enjoy protection. The skilful climber learns to take advantage of such shelters.

Mountains will even create wind-storms under certain conditions independently of the weather conditions in the vicinity. A steep precipice rising to a great height vertically or nearly so is often a breeder of storms even in the clearest weather. The sun beating upon the broad surface of the rock gradually heats the air to a surprisingly high temperature. The hot air rises, at first slowly but rapidly gaining velocity until it reaches the top of the stone wall. A partial vacuum is thus formed at the base into which a fresh supply of air rushes, so that the upward stream is continuous.

When the vertical air current reaches the top or ridge of the mountain it spills over the mountain crest and descends on the other side. The unexpected wind-storm suddenly springing up on a quiet day in a cloudless sky has often mystified mountain climbers. The phenomenon is known in the western States as the

Chinook winds. The Indians attribute it to evil spirits. A bewildering variety of air currents often assails the mountaineer in high altitudes.

CHAPTER V

THE TRAINING OF A MOUNTAINEER

MOUNTAIN climbing, like other athletic exercises, requires intelligent training. The more ambitious feats of climbing make serious demands upon one's strength and endurance. There are many ascents, especially in rock and snow work, where a supreme effort is required, as in a high or broad jump or a hundred-yard dash. Since the high altitudes are only reached by long continuous effort, the climber must develop powers of endurance comparable to those demanded of the long-distance runner. But while a spent runner may drop from a race at any moment, the mountain climber must always count upon a reserve of strength sufficient to bring him home in safety.

The beginner almost invariably suffers from over-confidence. Viewed from the piazza of mountain resort hotels, the ascents, the minor

ones at least, appear ridiculously easy. The paths and trails of the lower levels are clearly marked and reach upward invitingly. The long laborious training recommended by the guides appears unnecessary. Endless stories might be told of adventurous tourists who have accordingly come to grief. A typical case was that of a young American visiting the Swiss Alps recently who started out one morning, unattended, for a short climb. He reached his objective without mishap and, convinced that the mountain trails could be improved upon, took a short cut to his hotel. He lost his way, had a bad fall, and eventually found himself hanging over an abyss unable to retreat. He clung to this position for hours, when by a miracle of luck his cries were heard by a farmer in the valley far below, and he was eventually saved by a relief party.

However ambitious one may be, the training for mountain work should begin with short walks on the lower levels. The muscles are thus slowly hardened and the heart and lungs accustomed to new demands. In the mountain regions of Europe the beginner is therefore advised to keep at first to the mule-paths whose

ascent is gradual. Later, he is directed to the goat-paths, which offer stiffer climbing and mount to high altitudes. The climber is thus gradually accustomed to sustained exertion of steadily increasing difficulty. The mountain trails with their steeps ascents and rarefied air lie beyond.

The mountain guides recommend walks of from two to three hours daily at the beginning of training. A regular climbing suit should be worn with proper shoes and an alpenstock or ice-ax carried in the hand. In this way one grows accustomed to the suit, the heavy shoes, and the weight of the ax and equipment.

The walk is gradually lengthened as the climber becomes accustomed to the fatigue of trails of increasing difficulty and to the rarefied air he must breathe. There is a distinct mountain step pace which the climber must learn. The entire foot should be placed squarely on the ground with every step. It is well to start out at a very slow deliberate pace and as the step is mastered gradually accelerate it.

The heart as a rule quickly adapts itself to violent strains. It is a common experience,

however, to have the heart begin racing at low altitudes, which indicates that the pace followed is too fast and must be slowed down. The temptation under the stimulus of mountain air and scene is to start out much too rapidly. The tourist left to his own device almost invariably begins at a pace that soon leaves the seasoned guide far behind. It is the old story of the hare and the tortoise.

Training for mountain work at high altitudes must take into consideration the influences of the rarefied air upon the heart and lungs. Some men and women even of good physique are especially sensitive to such changes. Their breath, to use the familiar phrase, is shortened, and the heart may work overtime at an altitude of even a few hundred feet. Such people will not make mountain climbers. Few people, on the other hand, can depend upon normal heart action in high places. The professional climbers' advice to all beginners is to take systematic training beginning with short ascents, which gradually accustoms the heart to the exertion required of it under unusual conditions.

Nature seems to have made a special pro-

vision for mountain climbers by enabling the human body to adjust itself quickly to high altitudes. One ascending a mountain breathes an atmosphere which contains much less oxygen than he is accustomed to at lower levels. Many mountain climbers reach altitudes where the supply of oxygen is but one half that at sea-level. And a few hours' climb may bring them into this new world. The power of the human body to adjust itself to these rapidly changing conditions is surprising.

As the climber ascends, the number of red corpuscles in the blood increases sufficiently to meet the demands of the rarefied air. It has been found by scientific tests that on reaching an altitude of eight thousand feet the red corpuscles of the blood suddenly increase from five to six million, while by the time one has ascended to thirteen thousand feet they have increased to seven and a half million. Tests made at an altitude of eighteen thousand feet show the process of increasing the red corpuscles still to be in active operation.

If one be suddenly shot upward in a balloon, the best efforts of the body to readjust itself to new conditions are left far behind. The

strongest hearts and lungs fail under the strain, and the climber in this case becomes unconscious. By ascending slowly, or comparatively slowly, the mountain climber continues to keep a clear head and to retain his strength, which is a life and death matter for him. There seems to be little limit to the adaptability of the human body; certainly it does not fail even at the summits of the highest mountains in the world. On return to sea-level the race of the red corpuscles gradually slackens and ultimately regains normal conditions.

From his first step the climber should learn how to carry an ice-ax. It should be selected with great care to fit the climber's height and length of arm, while its weight must not impede progress. Much of the time it serves as a walking-stick. The ax should always be carried on the side toward the mountain and never toward the declivity or void. It will serve as a break in case of a misstep. If the climber on traversing treacherous ground will hold one end of the ax with his right hand and lean on the handle with his left he will find it impossible to slip. Among mountain climbers of all lands and tongues it is a universal prac-

tice that snow splashes should only be made on one side of the trail. In this way the trail is "blazed" over snow-fields so that other guides in crossing the routes taken by other parties will know at a glance in what direction they have traveled. If the footprints are indefinite or completely covered the splashes will give the right clue.

The mountain guides, by the way, have a system of communicating with one another by various markers and signals which they do not confide to the tourist. This language is common to their profession in many mountainous regions. It consists of a series of arrangements or groups of stones placed on the mountain trails which to the initiated convey a definite message. A guide coming across such a signal gains at a glance a surprising amount of information. The rough group of stones means nothing to the tourist, but the old mountaineer will know the size and nature of the party that has passed, the hour of its passing, its destination and equipment, and perhaps gain some hint of the liberality of the climbers.

The mountain climber must be a very early bird. A climbing party commonly starts out

at two or three o'clock in the morning—sometimes at midnight. After the would-be climber has served a sufficient apprenticeship in traversing mule and goat trails he makes a trial excursion to one of the mountain huts. Arrived there, he spends the night and leaves before dawn for his return. Night excursions like this give the climber valuable experience in walking in the dark over all kinds of trails and in the use of the lantern. With experience a party can in comparative safety climb about an abyss at night by the light of lanterns. It is essential that the climber know all the tricks of the trade before attempting an important ascent.

The training should be continuous, allowing, of course, sufficient intervals for recuperation. After a fatiguing day of practice climbing, an entire day is allowed for rest. The climber's strength and spirits are saved so far as possible by avoiding the heat of low altitudes, which is often severe. The start for the day is rarely made later than three or four o'clock in the morning. The climber must also grow accustomed to rapid changes of temperature. Since the temperature among the mountains

grows one degree colder for every three hundred feet of elevation, an ascent of upward of twenty thousand feet, if made in a few hours, places extraordinary demands upon the climber's physical endurance. On the more rugged mountains a climb measured perpendicularly by three thousand feet is considered a full day's work.

The regular course in mountain climbing required by the British Alpine Club is suggestive of the requirements in some university before the conferring of a degree. The training begins with a definite amount of rock and crag climbing among cliffs and mountains at home. Excellent preliminary experience is to be gained in Scotland. After satisfying the club requirements by this preliminary course, the students of climbing next turn to the Swiss Alps for advance work. After passing this experience to the satisfaction of the club examiners, a course in climbing is taken in the Caucasus. Next in turn the student climbs in the southern Alps. His European experience is now complete, and he must travel to New Zealand for special work. This acquired, he in turn climbs the mountains of Siberia. At the

end of this term he is considered qualified to assay the climbing of the Himalayas, which forms, so to speak, the post-graduate course in mountaineering.

The term "born mountain climber" is often loosely used as a term of flattery. Among mountain guides it is frequently employed to describe one who has extraordinary strength and staying powers at high altitudes. A man with a normal pulse at sea-level finds his heart beating at the rate of from ninety to ninety-five to the minute on reaching an altitude of ten thousand feet. The born mountain climber, other things being equal, has a normal pulse of sixty, which only rises to seventy-five when he is ten thousand feet up. Such people need little or no preliminary training.

Of the tens of thousands who every year climb mountains, few qualify for attempting the important ascents. Even after long training and preparation comparatively few succeed in reaching the summit of the great peaks. A special type of physical development is required. The vital organs must be above the normal condition. The climber must bring to

his task unlimited energy and must undergo long and persistent cultivation and training. Many are disqualified by their fear of high altitudes or by a feeling of dizziness developed in high places which may be unknown under normal atmospheric conditions.

To become a master of the art of mountaineering one must possess a remarkable delicate sense of balance. Even among trained athletes this talent is much more rare than is imagined. It enables the trapeze performer or equilibrist to perform many astonishing feats that seem to defy gravitation. Like these performers, the mountaineer must frequently balance himself on precarious ledges, when the slightest error in judgment may result in a fatal fall.

The mountaineer, again, must be cool-headed in the face of imminent danger. The nervousness or confusion of a moment may mean instant death. It is scarcely necessary to mention the obvious requirement of absolute fearlessness. The climber must remain imperturbable though the heavens or mountains literally fall. Many are called by the mys-

terious lure of the mountains, but few qualify to make the supreme effort that carries them to the famous mountain peaks.

Mountaineering is often said to bear the relation to mountain climbing that navigation plays at sea. The case is not quite parallel, but the comparison is nevertheless suggestive. Before the art of navigation was known in its modern scientific form, a vessel had to steer on its course, hit or miss, following only a general sense of direction. The course was often roundabout, necessitating great loss of time. The position of reefs and other danger-points was unknown. There could be no definite ship lanes or channels. The vessel was beset by a thousand dangers.

The science of mountaineering safeguards the climber, as in navigation, by fixing definite trails and charting every danger. It has standardized the rules of the game. The peculiar dangers encountered in every variety of climbing have been studied in the light of a century of experience among mountains in all parts of the world. There is to-day, therefore, a definite procedure, the result of all this ex-

perience, to be applied to every problem which may arise.

The early mariner venturing on uncharted seas had much in common with the hardy mountaineers who first assailed and conquered the famous peaks. Columbus and Magellan faced problems not dissimilar to those encountered by de Saussure and Whymper. They were the pathfinders both on land and sea. The uncharted slopes of Mont Blanc or the Matterhorn presented difficulties scarcely less appalling than the Atlantic Ocean in the fifteenth century.

To-day the Atlantic is crossed over a definite ocean lane safeguarded by every trick known to navigation. The mountain climber has a definite trail before him, fixed by expert mountaineers. He finds shelters equipped with supplies at frequent intervals. The most dangerous points along the way are safeguarded by ropes and railings. Meanwhile railroads climb to surprising heights over precipitous mountain-sides. There are many comfortable hotels at altitudes that once could only be reached by the most daring climbers. Some

climbers of the old school even regret the development of the mountaineering art which they think robs climbing of much of the element of danger and adventure and renders it prosaic.

CHAPTER VI

MOUNTAIN DRESS AND EQUIPMENT

IN all serious mountain climbing the clothes and equipment are matters of vital importance. It is not a question of selecting a costume that will be smart or becoming. The fashion-plate version of the Alpine climber is of course absurd. There is a stage Alpine climber which is merely a caricature, just as is the stage American or Englishman. Any one who ventures into high altitudes wearing conventional sport clothes, for instance, quickly pays for his ignorance or vanity by serious inconvenience, and perhaps with downright suffering. Lives have been lost through failure to select proper costumes and equipment.

Switzerland may be said to have set the fashions for mountain climbers. It is here, of course, that most of the problems of equipment have been worked out. The climbing suit is made of special cloth designed for the purpose.

The principal requisites are that the cloth be very warm for its weight, and that it should be waterproof under trying conditions. The fabric must be strong enough not to tear when stretched across jagged rocks.

The form of the suit is unimportant so long as it gives sufficient freedom of movement. It should have very large pockets for supplies of various kinds, as both hands will be needed almost continuously in climbing. The coat should be cut in such a way that it may be tightly buttoned about the neck, and so that, when occasion demands, the collar may be turned up to protect the ears. A muffler will offer the same protection, but it is a detached separate article of clothing which may be troublesome in high winds. Ready-made suits of this kind are sold in Switzerland and in many towns the world over, from which mountain climbers make their departure.

There is considerable difference of opinion as to the best form of leggings, trousers or uppers, different climbers finding more freedom of action in one or the others. Long trousers are of course out of the question. A special form of mountain boot has been designed with

stout uppers, heavy soles, and nails or cleats for snow and ice climbing. Shoes designed for city wear soon fall apart under the strain of climbing. Heavy woolen socks should be worn to guard against frozen feet. The hat should fit the head closely enough to defy a hurricane and should have folds that may be turned down over the ears. Many amateur climbers who have ventured forth in well fitting sport suits and shoes have returned almost barefooted, while essential parts of their clothing, such as the seats of their trousers, have been left on the jagged rocks.

A useful article of dress in climbing is the long Alpine scarf. It should be about six feet in length, of some heavy warm material. It can be used for several purposes, and is useful under all conditions: in cold, windy weather it proves valuable as a comforter; with a few skilful turns it serves as a helmet; wound around the body it becomes a warm sweater; when not needed for either of these purposes it may be worn as a waist belt; on cold nights in the open it can be utilized for sleeping socks.

The provisions carried on ascents naturally vary according to the habits or tastes or na-

tionality of the climber. No definite menu can be recommended. The food must, as far as possible, be concentrated and sustaining. Some guides venture into high altitudes burdened with small cooking-stoves in the belief that hot food is worth the effort of this preparation; early mountain climbers, of course, knew nothing of the magic of the vacuum bottle.

The dry air of high altitudes often causes intense thirst. It is a mistake wholly to satisfy one's thirst under such conditions, however, and only tea or coffee is recommended. Some guides carry wine and liquor, but the effect of alcohol under unusual atmospheric conditions at high altitudes is very tricky. The stimulating effect, which may be greatly exaggerated by the rarefied air, is likely to be followed by disastrous weakness or total collapse far from assistance. Men have actually died from delirium in the mountains.

Snow-blindness is a very real danger in high climbing. The reflection of bright sunlight on great expanses of snow and ice soon threaten the strongest eyes. Many forms of goggles have been designed for climbers. It is impor-

tant that the glass used should not be too dark. The sun on high mountains is often much more dazzling than at the sea-shore. Most climbers suffer intensely from sunburn. The outer skin quickly peels off in these high altitudes, and the process of healing is often very painful. A variety of preparations are available for painting the face for protection against the sun; in most of them soot or burnt cork is used as a basis. The appearance of such climbers, as may be imagined, is somewhat startling. The experiment has been made by many women climbers of using a heavy coat of rouge. The effect of such an application freely and evenly distributed is even more remarkable than the lampblack. The rouge does not stand the strain of high altitudes and soon melts, so that the progress of the climbers might be traced by red drops in the snow.

Many will recall the ice-creepers that were once commonly worn both in country and city to guard against slipping and falling on the ice. The name is misleading, since thus equipped one could step boldly over treacherous places, and not creep at all. The early mountain climbers knew nothing of this safeguard.

In snow and ice work the climber now uses a crampon or climbing-iron, which is an evolution of the old-fashioned ice-creepers. They are made of a framework of steel with large spikes and are fixed securely to the soles of mountain boots as skates are. The crampon materially increases the climber's pace, especially in covering snow and ice slopes.

It would seem that some form of rubber shoe would be very serviceable in rock climbing, just as the familiar overshoe lends one confidence in walking on icy pavements. A rubber sole is found of great assistance in climbing sharp or dry rocks, but proves very unsafe if the rocks be wet or even damp. Many bad falls have been caused by over-confidence in such footwear. In high climbing there is, of course, always more or less snow and therefore moisture, so that the rubber shoe of any form is likely to be dangerous.

For especially difficult climbing over smooth rocks, even the regular climbing boots are sometimes discarded and climbing is done in stocking feet. It has been found as a rule that one's footing is surer with a covering of wool than leather. The climber must avoid a

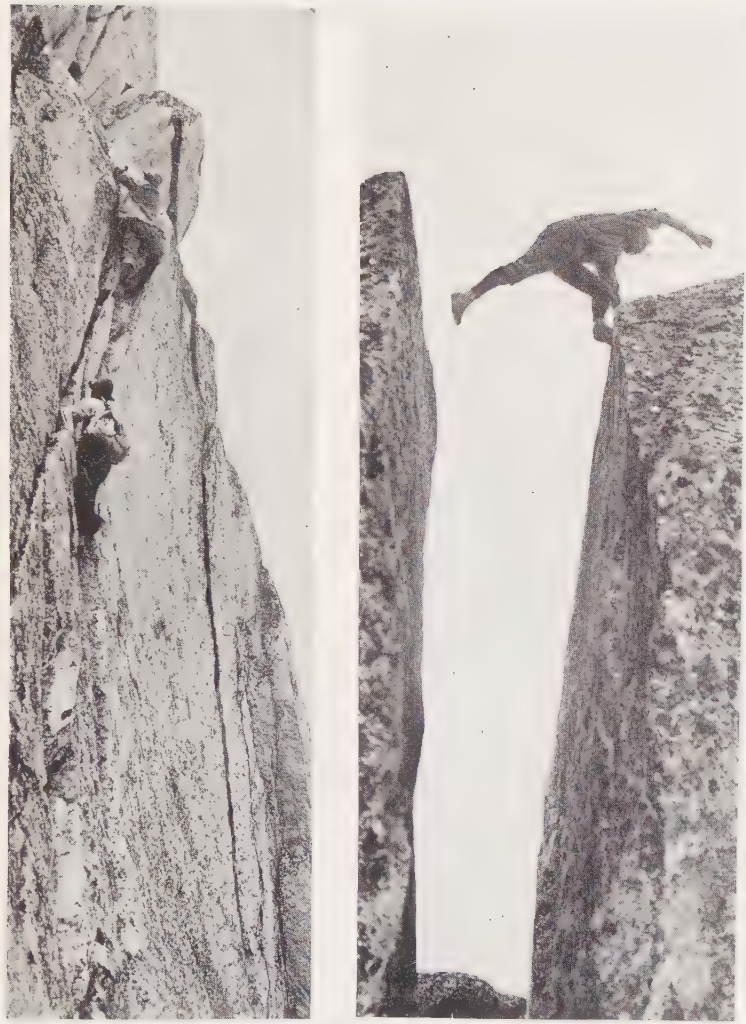
double stocking, since two surfaces of cloth are very likely to slip on each other. The best surface in climbing a dangerous rock is the bare skin, which will cling to very smooth steep rock faces where leather, cloth, or rubber may slip.

A rope thrown to a man struggling in the water is commonly called, in song and story, a life-line. The name applies equally well to the cord used for roping mountain climbers. Since a chain is only as strong as its weakest link, the rope is looked to with the closest attention. The standard rope for climbing, known as the Alpine club rope, is especially made for the purpose. It has three strands, and only the best manila hemp is used, which resists both damp and rot. The rope is readily recognized by a thread of red worsted that runs throughout its entire length.

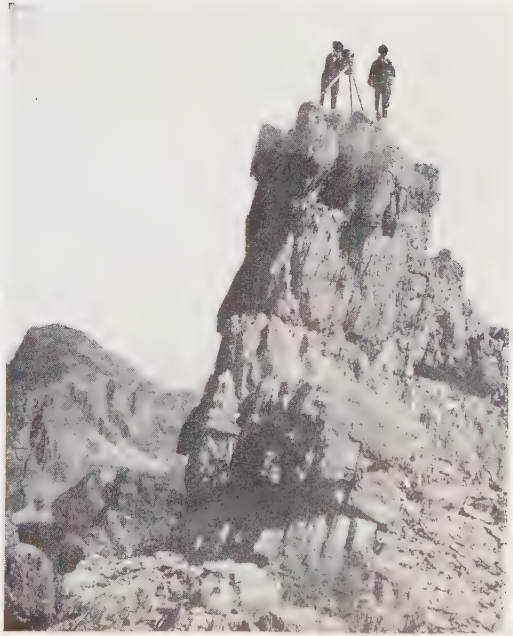
For the convenience of climbers Alpine rope comes in length of forty, sixty, eighty, and one hundred feet. In ordinary climbing a party of three requires a sixty-foot length. For more precarious positions an eighty-foot rope is used. The rope weighs at the rate of twenty feet to the pound, so that there is no object in

skimping in the supply carried. Distributed among the party, the weight is negligible. It is an imperative rule in the mountains that the ropes be carefully examined at frequent intervals for signs of weakness. The slightest wear upon the strands is noted and its condition closely watched. Many tragedies have occurred in the mountains through carelessness in making examinations of ropes throughout their entire length.

Before starting out on a climb the ropes are first wetted and vigorously tested. This is generally done by enlisting several assistants and indulging in a spirited tug of war for several minutes. The rope is then freed of all knots or kinks, stretched out to its full length, and left to dry in the open air. Tests of many varieties have been made to determine the strength of Alpine rope; and it has been found to break only after a strain of 1300 pounds has been suddenly exerted on it. In other words, should a climber, roped with these strands, suddenly fall, the rope would not part until the strain on his belt was greater than 1300 pounds. It seems likely that the climber's ribs would break first. The weight and strength of



DIFFICULT PROBLEMS IN ROCK WORK



MOTION PICTURES AT HIGH ALTITUDES

TYPICAL ROCK CLIMBING

Alpine rope, it will be seen, is calculated with every contingency in mind. Even if a climber should fall perpendicularly for a considerable distance, the standard Alpine rope, if well anchored, will bring him up with a turn. A much heavier rope might be used which would hold even if the climber fell much farther, but the jerk of stopping such a fall would itself probably prove fatal.

There is a surprising ignorance among laymen as to the use of the Alpine rope. It is not, as some imagine, a tether that prevents the member of the party from wandering off and being lost. It is not a ladder up which to climb. The rope when properly adjusted puts the entire party on equal terms, enabling each to share the advantage of his position and to share his strength with every other member of the party. The safety of one and all depends equally upon it. It is unnecessary to add that only an experienced hand should be intrusted with the knots.

In rope work in dangerous positions the best man of the party is always chosen to lead. The procedure is the same both in rock and snow climbing. In especially dangerous places

only one climber moves at a time, while the others cling to their positions in order to resist the jerk that would follow a fall of one of the party. Obviously the strain is thus minimized, and, should it come, the rest of the party are in the best possible position to resist it.

Should two men fall at once, all may be dislodged. On the steepest cliffs there is usually a ledge upon which the climber may sit and help the other members of the party. It is easy for an experienced man well placed on rock or snow to handle a man who has fallen and is dangling at the end of a rope. The man at the end of the string of climbers in descending, again, may throw the loose ends of the rope about a rock above him. When the movement is completed the rope can be retrieved by hauling the loose end from below.

The form and weight of the ice-ax have been determined by long years of experience. No golfer is more critical of his clubs than is the mountain climber of his ax. The length of the handle is suited to the height of the man or woman who carries it. For a man six feet in height the ax should be forty-four inches in length. The beginner should choose an ax

weighing about three pounds. It should be just long enough to serve as a convenient walking-stick. The head carries a blade on one side and an edge or pick opposite. The metal parts should be of wrought-iron tipped with steel and carefully tempered. A badly tempered ax is likely to split or break on coming forcibly in contact with hard rock. The size of the head varies considerably, thus enabling the climber to express his own taste and prejudices in making a selection.

It is important that the ice-ax balance properly. As a rule it should balance at a point about fifteen inches from the head. The climber's safety often depends upon his skill in balancing himself in precarious positions, and it is important that the weight of his ax should be in the right place. The handle is sometimes covered with india-rubber to assure a firm grip. The bare wooden handle is often treacherous, especially when covered with frost or ice. A sling is also used at times attached to the end of the handle; it can be thrown over the wrist, leaving the hand free.

The average climber will find that the pick is the more important feature of the ax and will

be used oftenest. It is indispensable in step cutting in ice or hard snow. It is usually slightly curved and about seven inches in length. In going up a snow or ice slope, when the angle is too steep to assure a good footing, a single well directed blow of the pick will cut a notch deep enough to assure a good foothold. The blade of the ax is slightly shorter than the pick end. Its commonest use is in scraping stone or ice footholds to afford secure footing. It also serves as a support in climbing. Nothing betrays so much a lack of experience in climbing as the swing the climber gives his ice-ax.

The summer tourist who follows the beaten trails of familiar mountains has little need of scientific equipment. His guide-book will give him any desired information as to elevation and barometric pressure. Should he venture to the higher altitudes he will find such observations completely charted in advance. Even his guides on the longer climbs know the trails so well that they dispense with everything but a compass or the simplest thermometer. In the populous resorts of the Alps, as in our own mountains, the necessary scientific data are as

well known as the dinner-hours at the hotels.

In any serious mountain climbing, especially in unfamiliar regions, the scientific apparatus for making observations is of course an absolutely essential part of the equipment. The daily observations are equivalent to punching a time-clock. It is from such records that the value of the expeditions is definitely established. Were it possible, the scientific expeditions would ascend with an immense amount of delicate and complicated apparatus. All equipment must, however, be reduced to the lightest and most portable possible form. Every ounce of weight to be carried places a definite handicap on an expedition. The apparatus must, besides, be of a simple durable nature which will withstand the most violent shaking up. In springing from rock to rock or glissading down long slopes the climber has no time to consider the effect on delicate apparatus. All instruments must be reduced to their simplest forms.

The only practical way of determining altitudes for the mountain climber is by measuring the atmosphere. The delicate mercury barometer is quite unsuited for the rough work

of mountain climbing. Imagine burdening oneself, on a steep rock face, with a fragile tube of glass several feet in length, which must, besides, be carried in a vertical position and kept from any vibration that would crack the glass. A sudden change of temperature might prove fatal, and if the vacuum for any reason deteriorates the readings are worthless. Such instruments have been laboriously carried aloft but have rarely been returned in working order.

Several ingenious modifications of the barometer have been designed for mountain work. To measure altitudes of fifteen thousand feet or over the tube must be from fifteen to twenty inches in length, and a fragile piece of glassware of this size is impracticable. There are several forms of pocket barometers, so called, but these cannot assure a perfect vacuum, and their readings are likely to be inaccurate. It is, besides, difficult to make sure that they stand in an absolutely vertical position.

For making rapid observations the aneroid barometer is found very convenient, but its readings are not sufficiently accurate. In ele-

vations of more than ten thousand feet it has been found to vary from five hundred to one thousand feet. Still other barometers are made with delicate springs, which, however, are likely to be seriously affected by change in temperature. Many serious disputes have arisen through the conflict of observations made in all seriousness. The mountain climber who has struggled to the tops of mountains is in no mood to be cheated out of his work by faulty apparatus.

The most reliable apparatus available to-day for measuring altitudes is the hypsometer, which measures the point at which water will boil at any elevation. The barometer depends upon the action of mercury, which often plays curious tricks on the observer at high altitudes. Water is much more dependable, and the point at which it comes to a boil can be relied upon to indicate the exact altitude. An ingenious form of the apparatus has been developed for mountain observation work which is readily portable and is not easily broken. The only breakable part of the instrument, indeed, is the little thermometer for taking the temperature of the water, but a number of thermometers

can readily be carried along to guard against accident.

The hypsometer must be operated in a more or less sheltered place as behind a rock or inside a tent. In very exposed positions, as on the wind-swept summit of a high mountain, it is sometimes impossible to find such shelter. The readings of this apparatus are amazingly exact. They give a measurement of altitude that is accurate to within ten or twenty feet. To gain as accurate a reading from a mercurial barometer it is necessary to take readings with one tenth of an inch. In practice, readings are usually made by both kinds of apparatus and checked against each other.

An interesting example of this method will be found in the official observations made by Professor Herschel C. Parker near the summit of Mount McKinley. The altitude and temperature readings were as follows:

Boiling-point: 194.00° (at sea-level 212°)
Air temperature: 29°
Aneroid barometer: 20.00 in.
Boiling-point corresponds to barometric pressure of 20.69 in.

Correction on aneroid: 20.69—20.00—0.69 in.
Reading of aneroid at highest point: 19.50 in.
Corrected reading: 20.19 in.

Experienced mountain climbers have a simple rule that enables them to tell the points of the compass from their watches or the time of day from their compasses provided they have the sun to help them. Should the sun be completely hidden, the same rule makes it possible to fix its position with the aid of a watch and a compass. On a dark cloudy day or when overtaken by storms this rule of the mountains may prove of vital importance. It may be of interest to repeat it here briefly.

The rule is surprisingly simple. The watch-face is held so that the shorter or hour-hand points straight at the sun. It is, of course, assumed that the watch is keeping fairly good time. Now, the line that bisects the angle between the shorter hand and a line running to twelve o'clock will point directly north and south. The minute division of the watch-face makes it possible to fix the points of the compass with sufficient accuracy for practical purposes.

Like all good rules, according to the proverb, this one works both ways. If you know the points of the compass the rule may be reversed and the time determined with considerable accuracy. If the points of the compass and the time of day be known, it is very simple, of course, to determine the position of the sun. These three pieces of information—the hour, the points of the compass, and the position of the sun—are, of course, very important to the mountain climber.

A wholly new problem has been brought into mountain climbing with the development of motion-pictures. When a motion-picture camera is carried to the peaks of mountains, the joys of mountain climbing may be shared by millions. The ordinary camera has done much to familiarize the rocking-chair mountaineer with the glories of high places, but such scenes as reproduced by the film gain animation and spirit. Sooner or later, therefore, the motion-picture camera must be carried at any cost to the highest mountain summits.

The difficulties of reproducing mountain scenery from the more inaccessible peaks are even more baffling than the layman may realize.

Motion-picture cameras are not only very heavy but awkward to manage at best. The sturdiest porters employed on difficult climbs rarely carry so heavy a burden, even in traversing ordinary snow-slopes. To attempt to ascend a steep rock face with such a handicap is to invite disaster. The weight, again, cannot well be shared between two or more men like ordinary equipment. There are many hours of climbing when the men as well as their luggage are constantly knocked about and banged against rock or ice faces, and many a camera has been ruined in the process.

It was feared at one time that even if the heavy cameras could be carried to the highest peaks the pictures obtained would scarcely repay the effort. It is virtually impossible to set up such a camera on a slope of seventy degrees or more, even with the help of guides. To assure good pictures the camera must be firmly placed and must be absolutely free from vibration. The slightest slip on a treacherous foundation may ruin the picture. In exposed positions, again, the vibration from the winds and snow-storms renders it well nigh impossible to get sharply defined negatives. When

it was first proposed to carry a motion-picture camera to the summits of Mont Blanc and the Matterhorn, the idea was ridiculed.

The mountain photographer has great difficulty in obtaining pictures that give an adequate idea of the height of mountains or of the steepness of their slopes. If the lens be pointed too far down, the steepest slopes will appear flat and uninteresting. As every amateur knows, the ordinary picture of a steep hill or incline, looking either up or down, rarely does justice to its general appearance. The motion-picture man who attempts to reproduce the beauty and impressiveness of high peaks must be something of an acrobat, a master of perspective, with a fine sense of artistic values.

The motion-picture camera has nevertheless been taken to the summits of Mont Blanc and the Matterhorn and many other peaks. The feat was first accomplished in both cases by the same man, Frederick Burlingham, a veteran British climber. On suggesting the possibilities of motion-pictures at these altitudes, Mr. Burlingham was ridiculed both by mountain climbers and photographers. Mountaineers explained that to carry so heavy a camera

would slow down the climb so that he might find himself at nightfall lost on the mountain-side far from shelter. Photographers questioned the value of pictures taken under such difficulties.

Mr. Burlingham's party, carrying a camera and thousands of feet of film, reached the hut on the Matterhorn at an altitude of ten thousand feet without mishap, and there they spent the first night. The start next morning was made at 2 A. M. The party was roped before leaving the cabin, an unusual precaution. They had not gone ten feet from the door of the hut when they found themselves on a treacherous snow-slope. Climbing with the aid of lanterns, they mounted rapidly for a time, when the steep face was reached. Under ordinary conditions, these rocks would have presented little difficulty, but the burden of the heavy camera was a greater handicap than had been imagined. With the added weight the danger of the rock faces was greatly increased, so that a single false step would mean death.

The party with the camera still intact halted for breakfast at an altitude of 12,576 feet.

When the next hut was reached it was found to be completely filled with snow and ice. A ridge with a knife-like edge was now reached, and it brought them to a halt. The guides advised the leaders of the party not to attempt to go farther, since they were seriously "overloaded" for such climbing. The mountain, besides, was found to be in bad condition. They pressed on, however, for four hours more.

The shoulder of the mountain was thus reached. In this region Whymper had met with the tragic accident in which three of his party were lost. Once more the guides urged that the attempt be abandoned. The shoulder was rendered especially dangerous by the high wind that swept across its face. Since Whymper had come to grief on these rocks while climbing without any burdens, it was obviously far more dangerous for the present party, handicapped with their heavy camera.

While clinging to this precipitous face, and despite the gale of wind, the camera was unpacked and set up. It was necessary to cut steps in the ice for the camera and the operator. During the process and the taking of

pictures the party was roped together. It was found especially difficult to keep the climbers in position in the range of the camera. The pictures taken, the party now struggled on, and the camera was finally carried to the rocky summit of the Matterhorn. A marvelous picture was made from this vantage-point. Had the photograph been taken upon plates instead of films they probably would never have reached the valley intact, for the camera was badly abused. In descending, the climbers went down face outward at times looking directly down for several thousand feet.

Nothing daunted by the Matterhorn experience, Mr. Burlingham later attempted to carry a motion-picture outfit to the summit of Mont Blanc. He was accompanied on this trip by his wife. When the party reached the Grands-Mulets they built a refuge for themselves on the sharp rocks. They were threatened by a great avalanche, which luckily fell just south of them. In one of the most difficult parts of the ascent Mrs. Burlingham fell and broke one of her ribs, but the camera, although knocked about with great violence, was in good condition when the summit was

reached. By rare good fortune the weather was unusually clear, and the panorama enjoyed from the peak was reproduced with success.

CHAPTER VII

THE CONQUEST OF MONT BLANC

"I HAD reached the end of my journey. I had come to a place where no one—where not the eagle or the chamois—had ever been before me. I had got there alone, without other help than that of my own strength and by my own will. Everything that surrounded me seemed to be my own property. I was the King of Mont Blanc—the statue of this tremendous pedestal."

This famous description of the conquest of Mont Blanc is unique in literature. When Jacques Balmat first achieved the highest point in Europe in 1786 he indulged in no such flights of imagination. His fame had quickly spread over Europe, however, and some time later it chanced that Alexander Dumas met him in the Alps and heard his story. The colorful description of Balmat's achievement of Mont Blanc, although written in the first per-

son, is actually the work of the great writer of romance, and reads like an adventure of "The Three Musketeers" or "The Count of Monte-Cristo." The race of mountain climbers is usually modest and little given to boasting. The actual record of events proves stranger than any fiction Dumas could imagine.

Balmat made his first attempt on Mont Blanc alone. Leaving his home early one morning, he proceeded rapidly by way of the Côte and the Glacier des Bossons and succeeded in reaching the three conical rocks known as the Grands-Mulets in seven hours. Here he rested and made a meal of bread and brandy. It was soon evident that he had gone too far to return the same night. At that time there were, of course, no Alpine huts at these altitudes, and the intrepid pathfinder must make the best of his position.

After searching in vain for shelter, Balmat was forced to camp for the night on a bare rock but six feet in circumference poised precariously on the mountain-side. There could be no thought of sleep. A sheer precipice fell away on one side of the rock for eight hundred feet. Balmat had already been wet to the skin.

For the rest of the night he clung to the rock in the face of a keen wind and a heavy fall of snow. To fight against freezing to death he must keep in motion, which on so treacherous a rock was a dangerous expedient.

Balmat later told harrowing stories of his loneliness throughout the night, which was increased by the cannon-like reports from the cracking of great ice-cakes. Morning found him alive, but with every article of his clothing solidly frozen to him.

When day finally broke Balmat discovered three other mountain guides in the same region. The sight of a human face should have been welcome after such a night, but Balmat was intent on his purpose, and he regarded the men as possible rivals and resented their presence. It was impossible to go farther in his condition, and he returned home to change his clothes and secure food. He was so fearful that some one might steal a march upon him that he was soon back on the mountain trails.

Undismayed by his experience, Balmat spent the night near the camp of his first journey and was early afoot next day. By three o'clock in the afternoon he succeeded in reaching the

Dôme de Goûter. Here to his consternation he came across two other guides who were on the mountain for the same purpose. After years of struggle to reach the coveted goal, the race was neck and neck. Balmat soon separated from the guides, determined to succeed or fail alone.

It was thus entirely by his own unaided efforts that he reached the narrow ridge that unites the Dôme with the summit of Mont Blanc. He realized that the only possible course was to cross the precarious trail. The ridge at this dizzy altitude is but a few inches in width and falls away on either side into abysses thousands of feet below. Nothing daunted, Balmat got astride this knife-like edge and proceeded to drag himself foot by foot upward.

With supreme effort he balanced himself against the winds and snow and painfully crept on for about a quarter of a mile, when he was abruptly stopped by the ice. There was no way around, and, with a disappointment that may be imagined, Balmat returned to the Dôme. The two guides he had left there a short time before had disappeared.

Balmat seems to have encountered every danger and anxiety known to mountain climbers. Shortly after this keen disappointment he was climbing a snow-slope when his staff suddenly warned him of a new danger underfoot. A moment later the snow began to sink beneath his feet. He had blundered on the verge of the Grande Crevasse. A less skilful climber would have been lost. With the instinct that comes from long experience in snow work, he flung himself backward just in time to regain solid ground.

Balmat found himself alone on the mountains and too far away to return before the light would fail. This time he camped at a point two thousand feet higher than the night before. It proved to be a harrowing experience. The snow fell in sharp pellets, driven by the high winds, and they cut his face like ice. He was nearly overcome by the fatal drowsiness that usually numbs the faculties before a man is frozen to death. Several times in the night when his courage nearly failed he was cheered by hearing sounds from the valley beneath, brought up to him by the curious tricks of mountain acoustics. The barking of a dog

was distinctly heard. The morning brought a heavy fog, and Balmat was once more obliged to return home.

The final attempt that was to become famous in the history of mountain climbing was made on August 7, 1786. Balmat was accompanied in his last and successful attempt by his physician, Dr. Paccard. The two men kept their plan a secret, and in order not to arouse any suspicion of their object they started from their village by different routes. They made excellent progress until they reached the Grande Crevasse, when their troubles began in earnest. It was necessary to cross a narrow ice-bridge where a single careless movement would mean instant death. By crawling literally on their hands and knees over these treacherous trails they both reached the Dôme de Goûter.

At this point Dr. Paccard collapsed and found it impossible to proceed. He was made as comfortable as possible, and the intrepid Balmat started on alone. After conquering so many difficulties Balmat nearly succumbed from difficulty in breathing, with the goal at last in sight. He hit upon the simple expedient of tying a handkerchief over his mouth,

when he found instant relief. Pressing rapidly forward, he now at last reached the summit. In many respects his feat is unique. His courage and persistence had in turn overcome virtually every difficulty and danger of the mountains. In his wanderings he had traced a route which has since been in the main followed.

With Balmat's aid his companion finally succeeded in reaching the summit as well. The two famous climbers imagined they had successfully passed every danger, but still other perils were to be discovered. The following morning at six o'clock Dr. Paccard remarked suddenly: "What a strange thing! It is quite dark, but the birds are singing." His eyes were wide open, but he was wholly snow-blind. For many days afterward he could only see at twilight. For weeks after reaching home the faces of the climbers remained quite black, the eyes red, and the lips blue, and when they smiled or yawned blood spurted from them. But news of the conquest of Mont Blanc quickly spread over Europe and the world.

The most famous mountain climber in his-

tory is doubtless Horace de Saussure, who reached the summit of Mont Blanc a year later than Balmat. De Saussure is affectionately known as the "father of mountaineering." He was the first to risk his life in the ascent for the purpose of making scientific observations, which assures him a fame more enduring than that of the mere adventurer or paid guide. A statue has been raised to his memory in the shadow of Mont Blanc, and countless pictures celebrating his achievements are familiar the world over. In one of these he is shown bravely facing the dangers of an avalanche attired in a long-tailed coat and wearing a silk hat, which at least suggests something of the dignity of his enterprise.

De Saussure had been for years the professor of natural philosophy in the college at Geneva, and he had planned the ascent many years before Balmat's adventure. His scientific party reached Chamonix in July, 1787. It consisted of eighteen guides and personal servants, with an elaborate equipment of scientific instruments for making observations, a tent, and provisions. Every preparation that experience could suggest had been perfected long

in advance. The first night was spent at the foot of the mountain. Excellent progress was made by the party on the second day, and at night all crowded into the single tent for protection against the extreme cold.

The summit was reached on the third day. It was found impossible to take all the observations that had been planned, but the trip nevertheless contributed much to scientific knowledge. The scientist who risked his life in the cause of his profession has been the inspiration of countless scientific expeditions throughout the world.

The special dangers of the ascent of Mont Blanc were now recognized, and trails are fixed that avoided the obvious perils of the higher altitudes. Shelters have been built at various stages of the long journey, where the climbers may spend the night in comparative comfort despite the severest storms. A great force of guides have traversed every conceivable trail and learned to know the varying moods of the mountain, the probable paths of storms, and their duration. The element of danger has been slowly but surely diminished.

Many women have reached the summit of

Mont Blanc. The distinction of being the first was won by a native of Chamonix named Marie Paradis. For a long time no guide could be found who would venture on the high slope with her, but she finally reached the summit in 1809. She was but twenty-two years old at the time. In 1856 an Englishwoman also made the ascent without mishap.

In the literature of mountain climbing the adventures of the "bride of Mont Blanc" will always remain unique. Although not the first woman to ascend Mont Blanc, Mademoiselle d'Angeville's feat was by far the most dramatic. Mademoiselle was a French aristocrat who had narrowly escaped the Revolution, and she brought to the enterprise unlimited means and courage. Her friends made every effort to dissuade her from making the attempt. In planning the ascent, special attention was paid to her wardrobe, in order that her appearance, in her own words, might be, "impressive and picturesque." She designed her dress with care and wore a velvet mask, a veil, green spectacles, and a fur-lined pelisse of fashionable cut.

On the night before starting the climb made-

moiselle sat up till past midnight writing to her friends, a unique training for such an effort. The start was made at six in the morning, the procession passing the hotels, where crowds of tourists shouted a farewell. In addition to the ordinary supplies, mademoiselle had provided eighteen bottles of wine, three pounds of fruit-plums, one blanc-mange, and one gourd of orgeat. It is safe to say that such luxuries have never been carried to the summit of Mont Blanc before or since.

It was soon proved, however, that mademoiselle had a sufficient store of courage. A difficult crevasse was soon encountered, which was crossed by two of the guides with difficulty. The guides now turned doubtfully to mademoiselle and asked, "Can the lady pass?" The reply was reassuring. "The lady can pass anywhere two men have preceded her," she said.

The Grands-Mulets were reached by two in the afternoon, when a tent was pitched and the party prepared to pass the night. It chanced that a Polish nobleman was also camping out on the snow in this lonely region, and on hearing of the other party he sent his card by a guide and asked permission to call and pay

his respects. The formality on this remote mountain crag is delicious.

The request was granted; the two parties joined forces for the evening, and a concert was organized. The guides sang their national songs. The festivities were suddenly interrupted by an avalanche, which just missed the camp in its rush down the mountain. An early start was made the next morning, and the party rapidly mounted the lower slopes. On reaching the ice-fields of the Grande-Côte at least one member of the party suffered acutely from mountain sickness. Mademoiselle d'Angeville has described the discomforts of this curious effect of high altitude in her diary.

"I had to struggle," she wrote, "against two enemies of equal violence, a suffocating palpitation of the heart when I walked and a lethargic drowsiness when I stopped. I was obliged to wind up all my will-power as far as it would go, and in this way I obtained a nervous paroxysm of strength, which lasted a few minutes and enabled me to struggle on for seven or ten paces; then my heart beat again as if it would burst through my chest, and, when the

suffocation came, threw myself on the ground overcome by the stupefying drowsiness. I was in a state of agony for hours without thinking for one moment of giving up my enterprise."

Several times the intrepid climber fainted. The guides implored her to turn back again, and were uncertain if it was not then too late for her to reach the foot of the mountain alive. Mademoiselle was game to the end. On recovering consciousness after a long fainting spell she said to one of her guides, "If I die before getting to the top, drag my body up and leave it there; my family will reward you for executing my wishes." At such a price the summit was finally reached.

It was a pleasure to know, to quote the diary again, that "vigor returned to my limbs, and it was in the full possession of my nerves and physical faculties that I admired this magnificent and imposing spectacle which presented itself to my gaze." Mademoiselle then directed her guides to raise her as high above their heads as they could, that she might have the distinction of having been higher than any one in all Europe.

Two incidents of the trip deserve mention.

For one thing, while on the summit mademoiselle wrote a number of letters to her friends. After beginning the descent the guides asked if they might express their admiration and esteem for the lady by kissing her. The request was granted, and mademoiselle observes in her note-book that so robust was the greeting that she was sure the kisses were heard in Chamonix.

Mont Blanc might have been especially designed, so well does it satisfy every demand mountain climbers may make upon it. The serious mountain climber finds in its upper altitudes problems to test his utmost skill and endurance. On its lower slopes every conceivable variety of mountain climbing may be enjoyed. These varied attractions are shown by the surprising growth in recent years of Chamonix, the picturesque Swiss village at its base. A few years ago it was a scattered village; to-day it is a busy and progressive town.

The most difficult problems of climbing are conquered in the middle ascent of Mont Blanc. The climber may test his skill and staying-powers on the séracs and in crossing crevasses and snow bridges. The summer idler or the

least ambitious mountain climber can readily find an expedition exactly suited to his strength and inclination. One party comfortably established on mule-back starts out for Montavert. Another walks on the Mer de Glace; still others scramble down the Mauvais Pas. Greater variety may be enjoyed by a visit to the Glacier des Bossons, and to the waterfalls and ice séracs. The ambition of thousands of amateur mountain climbers is even satisfied by being photographed while crossing the glacier. Daily parties are recruited to climb to the outlying peaks, where more extended views may be enjoyed. From these moderated adventures the amateurs return to their comfortable hotels at night and speculate as to whether they could "do Mont Blanc."

Until about eight years after the conquest of Mont Blanc, the peaks of the Apennines seemed to have attracted little attention among mountain climbers. Their highest peak remained unclimbed. The pioneer of the Apennines, the first man to reach these summits, was Oranzio Delfrico, who wrote entertainingly of his adventures in 1814. The awe and horror inspired by the high mountains throughout the

Middle Ages was still potent. The first climber who dared the dangers of this region was something of a scientist, since his equipment included four thermometers and two barometers.

It is curious to find even at so late a date that the climber was still struggling with the superstitions and fears of the Dark Ages. He looked upon the mountain-peak with "shuddering horror" but nevertheless persevered. The first stage of the ascent was made by carriage; then the party abandoned them and "trusted to our own legs." An early start was made for the last stage of the climb, and, at sunrise, all spent some time admiring the mountain before them in the early morning light, which indicated that the climbers had something of the modern spirit.

The Italian mountaineer describes the ascent as being "most rough and unpleasant." The snow-line was reached, and the party soon found themselves above the clouds. "This," the narrator explains, "was an advantage as it concealed from our view the precipitous and huge abysses beneath our feet." The spirits

of the climbers improved as they ascended, and the mountain seems to have lost its ancient terror. When they stopped to rest at a considerable altitude we learn that the climbers "recovered strength and felt a certain agreeable jollity, which speedily made us forget what we had undergone."

The climbers were naturally delighted to reach the summit, and we find the narrator explaining: "I arrived at the desired goal of my fatiguing journey. The snow of the mountain summit formed a small inclined floor, covered as it were on a large stone table, laid upon the mass of rock, and serving as a bed for all our company to lie down upon." The elevation of the mountain was found to be 9577 feet. The climber comforted himself by reflecting that it was higher than Vesuvius.

The conquest of the Pyrenees in Southwestern Europe was accomplished at about the same time that the Alpine peaks were climbed. Its three highest peaks were found to be Aneto or Pic de Néthou, 11,168 feet, Posets, 11,047 feet, and Mont Perdu, 10,997 feet. The region has been carefully examined by members

of the English and French Alpine clubs especially since 1888, who have added much of value to the world's knowledge of the geography and geology of this region.

CHAPTER VIII

CLIMBING THE MATTERHORN

THE bewildering difficulties of the Matterhorn long continued to challenge the most fearless mountain climbers. It was the last of the great Alpine peaks to be conquered. More than fifty years after Mont Blanc had been scaled, and despite the advance in the science of mountain climbing and the confidence thus acquired, this precipitous mountain still baffled every attempt directed against it.

The upper regions of the Matterhorn were protected for centuries by the medieval superstition that evil spirits dwelt in these high places. Mountain guides could not be bribed to venture to these altitudes. The more superstitious of the natives who lived about its base believed that a ruined city existed on the summit of the Matterhorn, where these evil spirits dwelt. The curious rock formations at the top were pointed out in proof. Should any

one approach the summit, it was argued, the offended spirits would hurl down stones upon their heads. When the summit was finally reached, and stones rolled down as a signal of the victory, the natives were convinced that the spirits were still active.

The bold profile of the Matterhorn, rising sheer to an altitude of fifteen thousand feet, is impressive from every point of approach. It has no rival in Europe. Its difficulties have a curious fascination for mountain climbers. The actual peak rises abruptly for nearly eight thousand feet above the glaciers that surround its base. Here are precipices absolutely perpendicular, while others actually overhang. These rock faces are interspersed with hanging glaciers and towers and spires of rock and ice. The unbroken lines of the cliffs and the general simplicity of the outline of the mountain seem to render it absolutely unclimbable.

To the layman the precautions taken by mountaineers in planning their ascents will come as a surprise. The various contours of the mountains, the exact angles of its several faces, and the best means of approach are studied with the same attention an engineer

employs in laying out a railroad. This phase of mountaineering has been reduced to an exact science. The methods employed are admirably illustrated in the assaults on the Matterhorn. The story is told of a great Dutch architect of the Middle Ages who, on being commissioned to build a cathedral, first sat quietly for a year, pipe in hand, looking at the site before he drew a line upon paper. It was thus that the mountaineers studied and meditated upon the slopes of the Matterhorn.

To the casual observer it is merely an inspiring peak rising almost vertically to a great elevation. The familiar eastern face is apparently the most difficult and has always been considered impossible. The familiar photographs of the Matterhorn deceive the eye. The mountain appears to be an isolated peak rising like a great tooth from its plateau. It is in reality the end of a range of mountains, and the approach to the summit seen from this side is much more gradual.

The first attempt to climb the Matterhorn was not made until the year 1858, when a well organized party succeeded in reaching an altitude of but 12,652 feet. A year later a party

of Englishmen, undismayed by the earlier failure, tried the ascent without the assistance of mountain guides. They selected as their approach the famous eastern face of the mountain, which presents a smooth cliff, apparently the least promising of all its slopes. The party, besides, attempted to reach the summit in a single day without "sleeping out" in the mountaineering phrase, or spending a night in the open.

They proceeded without accident up the steep face until the ascending angle proved too much for them. This brought them to an elevation of 10,280 feet, when they proceeded to zig-zag up the face, first turning to the left and later to the right. Their best efforts carried them only eight hundred feet higher, a total elevation of not much more than eleven thousand feet. A high wind was now faced, and the climbing was complicated by heavy clouds. At the approach of night the party turned and succeeded in reaching the valley in safety.

Shortly after this failure a party including Professor John Tyndall, the famous scientist, attempted the ascent from another side. They

succeeded in reaching the point at which earlier explorers had turned back; there the party rested while Professor Tyndall and another went on alone. After climbing for some distance they decided that time did not allow a further advance and returned. The point at which the party paused was 12,992 feet up, while the final effort carried them perhaps sixty feet higher, thus making a gain of but four hundred feet beyond any previous effort.

Still another attempt was made in the same year, but this party was also obliged to turn back for lack of time. It ascended a trifle higher than those that had gone before, but frankly admitted that the difficulties before it when it turned about were daunting. All these climbers, including Professor Tyndall, brought unlimited courage and great practical experience to the task.

Hope springs eternal in the breast of the mountain climber. Despite these repeated failures, Edward Whymper, whose name will ever be associated with that of the great mountain, attempted the ascent with a single guide in the summer of 1861. Whymper brought many talents to the task. In addition to being

one of the most skilful and daring of climbers, he was a keen observer, and was especially happy in describing his extraordinary experiences. No climber of mountains has probably done such justice to the beauty of these high altitudes and their poetic charm.

On the first night of Whymper's expedition he slept in the highest cow-shed on the mountain-side. The party was afoot early in the morning and made good time until they were halted by a wide crevasse that necessitated a change of route. The day was spent to good purpose, however, and excellent progress was made. Unlike most of his predecessors, Whymper had planned to "sleep out" on the mountain-side and had brought a tent of special design for shelter.

The night fell bitterly cold. Camp was pitched, and the party turned in. Some hours later all were awakened by a terrifying explosion followed by a scarcely less terrifying silence. A great avalanche of rock had been loosened from the steep slopes above them. The guide wrung his hands, exclaiming, "We are lost." The avalanche was close at hand, and small rocks fell upon the party, but the

THE FAMOUS EASTERN FACE OF THE MATTERHORN

INTERIOR OF A MOUNTAIN CLIMBER'S HUT IN THE ALPS

mass passed the camp by a narrow margin and thundered on down the mountain-side. The party was undismayed and at daybreak continued the ascent.

Some idea of the steepness of the mountain-sides and the depth of the abysses may be gained from the fact that when a bottle was thrown overside the crash far below was not heard for more than ten seconds. Whymper's description of the mountain echoes at these altitudes has caught the illusive charm of those high places. "We shouted," he writes, "to awake the echoes from the cliffs. Ah, there was no answer. Not yet; wait a while—everything here is upon a superlative scale, count a dozen and then the echoes will return from the walls miles away, in waves of pure and undefiled sound, soft, musical and sweet."

After reaching the highest point that had yet been attained, a supreme effort was made to scale a famous "chimney" of the Matterhorn. It is a straight slab of stone, treacherously smooth, which rises at a steep angle between two similar formations. Whymper succeeded in reaching its top, but his guide failed, and with this achievement to his credit

Whymper was obliged to turn reluctantly homeward.

A novelty in mountain climbing was attempted in the following winter. The ascents had heretofore been attempted in the month of June, but now a fearless young English climber made the ascent in January. He had worked out an interesting theory that the ice and snow in midwinter would prove less treacherous. Considerable progress had been actually made when a storm on the mountain brought the party to a halt, and it was found impossible to face the ice and snow. A cairn of stones to mark the furthest point attained was built at an altitude of 10,820 feet, which was a remarkable achievement under the circumstances.

Undaunted by many disappointments, Whymper planned still another attempt the following year. An unusual feature of his equipment was a tent especially constructed to stand in precarious positions on the mountainsides. The Whymper tent is still the standard form in mountain work. The party had made encouraging progress when the guide had a bad fall and the two were obliged to turn back. On the following day another attempt was

made, but now the guide fell ill, and they must again return. Whymper next set out without guides, resolved to face the dangers of the mountain undaunted.

He had succeeded in reaching an altitude of fifteen thousand feet when the precipitous icy walls of the mountain proved insurmountable. After a severe fall he again had to return. Once more he tried, this time with two guides, only to be forced again to abandon the attack. Whymper had now failed after six attempts. Two years later in 1863 Professor Tyndall, after careful preparations, made another attempt but failed, and again in 1865 he once more assailed the precipitous walls of ice only to meet again with disappointment. The field was still clear.

Whymper after long study of the famous eastern face now discovered that the angles of the slopes were far less abrupt than they appeared to the casual observer. The slope seemed to rise to a prodigious height at an average angle of seventy degrees, much of it being virtually perpendicular. It took several years of study to convince Whymper that the impression given from this side was erroneous.

He first noticed that certain patches of snow on this face did not melt throughout the summer months. This indicated that large masses of snow must have accumulated there and remained in this position. Now, it is generally known that snow will not remain on a mountain slope of more than forty-five degrees. If the angle is greater than this it will soon slip off. Whymper thereupon climbed to a point where he could see this face in profile, and was amazed to find that the appearance of the Matterhorn from this point was completely transformed. The apparently perpendicular face actually stood at an angle of forty degrees.

Here was a great discovery. A mountainside rising at an angle of forty degrees is usually climbable, at least for short distances. This face of the Matterhorn rises for a full three thousand feet, and a continuous climb at this angle is a supreme test of endurance. The face of the Matterhorn, however, had discouraged climbers not only because of its steepness but also because of the apparent smoothness of its surface. As one gazes up at it from the valley there seems to be no possible foothold over large areas. Whymper next made a care-

ful study of the rock formations of the eastern face, especially to determine the dip of the rock ledges. He decided that the strata of rock formed a great natural staircase on the eastern face which would be of great assistance in climbing.

The face of the mountain was too far away to make close studies. Upon long observation Whymper decided that after a snow-storm on the upper slopes in the summer months the eastern face was covered with long terraced lines more or less parallel to each other, which indicated the presence of these step-like formations. To convince any one of this, even the guides most familiar with the mountain, he found very difficult in the face of the general opinion. When the guides were taken to a point where they could see the eastern face in profile they expressed their surprise, but they still believed the slope unclimbable and refused to make the attempt.

The route finally adopted by Whymper was based upon these ingenious observations and conclusions. To many old mountaineers his plan seemed madness itself. Any one familiar with the eastern face of the Matterhorn alone

will probably agree with them. He proposed to climb first the southeastern ridge, and actually to cross the famous eastern wall. This would lead across the great patch of snow shown on the eastern face in the accompanying photograph. The line of march crossed the snow-field diagonally to the northeastern ridge just below the summit. The course would then extend up the north side of the mountain where the broken rock and snow promised fairly good climbing.

In 1865 Whymper once more returned to the attack. Profiting by his long experience, he now organized a party of eight and carried provisions for three days. Special attention was paid to the method of roping the party. The climbers, when they began their ascent, discovered that the perspective had played curious tricks on them: many places which from the foot of the mountain appeared extremely hazardous were, when reached, so easy that they could "run about" on them. The tent was pitched the first night about eleven thousand feet up.

The party next day soon reached an altitude never before attained, and pushed forward

with growing excitement. The steep icy slopes of the Matterhorn were found to be wholly different from what was expected. The work became increasingly difficult, however, and required the most anxious caution at every step. But to the amazement of the climbers the general slope of the mountain was less than forty degrees.

The rock face was covered with snow which had filled every crevasse, so that only occasional fragments of rock projected at intervals to offer secure footing. At times the entire surface was covered with a glaze of ice, which proved extremely treacherous. As the party climbed painfully upward the conditions improved. The course at the higher altitudes was intricate but presented no insurmountable difficulties to experienced climbers. On successfully passing about an especially difficult corner, the top of the Matterhorn was seen but two hundred feet above them, while no serious barrier intervened.

Before setting out on his final expedition Whymper had heard that a well equipped party of Italians had started on the same errand two days ahead of him. So far nothing had been

seen or heard of the rival party. It was now four days since the Italians had started, and the Whymper party were tormented with anxiety that they might find their rivals on the summit. Every snow-field was scanned, every profile of the mountain watched with an anxiety that may be imagined. As Whymper approached the summit the excitement became painful. No trace of the Italians was found on the way, but they might have stolen a march, and their footprints might have been covered by recent snowfalls.

The suspense of the Whymper party continued to the last. Climbing at their best speed, they pushed on and finally reached the summit. The snow, so far as they could see, was unbroken. It was found, however, that the summit of the Matterhorn comprised a fairly level ridge about three hundred and fifty feet in length. It was still possible that the rival party was concealed somewhere about. Every foot of the summit was hastily explored. No trace of footprints was anywhere to be found: Whymper was the first to scale the Matterhorn.

From their vantage-point atop the Matter-

horn the successful party looked down upon the faces of the mountain and soon discovered their rivals, mere specks of black, on a snowy ridge two thousand feet below them. The victors shouted singly and in chorus to attract their attention, but at such a distance it was impossible to tell if they were heard. There were other means at hand, however, for making an unmistakable signal. The party at once set to work prying loose rock and tumbling it over the edge. An avalanche was soon in motion from the highest peak of the Matterhorn. A moment later the rival party was seen to turn and hurry away.

The tent-pole was now raised at the summit and a man's blouse hung to the breeze by way of signal. It was observed by anxious watchers at Zermatt in the valley below, and the news of the conquest of the Matterhorn soon spread. A natural mistake had been made, however, in interpreting the signal. The Italians believed it to come from their own countrymen and celebrated accordingly. It was not until the party of Italians reached Zermatt that the truth was learned. "It is true," they reported. "We saw them ourselves; they hurled stones

at us. The old traditions are true; there are spirits on the top of the Matterhorn."

By a fortunate chance Whymper had reached the summit of the Matterhorn on a day of exceptional clearness. The mountains more than one hundred miles away were sharply etched against the sky. The labor of years, the innumerable dangers that had been faced were at last rewarded. It is often asked why mountain climbers devote years of effort and chance their lives to reach a mountain peak. There is probably no more convincing answer in all mountain literature than the words written by Whymper on reaching this goal. Almost he persuades us to face similar dangers, for such a reward.

"To the west," he writes, "gorgeous in the full sunlight rose the monarch of all—Mont Blanc. Ten thousand feet beneath us were the green fields of Zermatt dotted with chalets, from which blue smoke rose lazily. There were forests black and gloomy, and meadows bright and lively, fertile lands and savage wastes, sunny plains and frigid plateaux. There were the rugged forms and the most graceful outlines—bold perpendicular cliffs, and

gentle undulating slopes, rocky mountains and snowy mountains, somber and solemn or glittering and white with walls, turrets, pinnacles, pyramids, domes, cones and spires. There was every combination that the world can give, and every contrast that the heart could desire.

"We remained on the summit for one hour—

" 'One crowded hour of glorious life.' "

"It passed away too quickly and we began to prepare for the descent."

But the conquest was to end tragically. The descent was commenced with the utmost caution. Six men were securely roped so that if one should fall he might be saved by the others. It chanced that one of the party slipped in the descent and, falling against the man next him, knocked him over. The third man in the line was dragged from his position. The others including Whymper recognized the danger and clung as firmly as possible on the rocks, bracing themselves for the shock. The rope was taut between them. A moment later there was a sharp jerk, but they held fast. All would have gone well, but at this critical moment the

rope broke, and three men plunged down the steep face of the Matterhorn.

For a moment they could be seen sliding at fearful speed down the side of the mountain, grasping frantically at the rocks to stay themselves. A moment later they were launched into space and fell four thousand feet. Three men, two of them guides, with the intrepid Whymper roped between them, were thus left clinging to the precipitous sides of the mountain at this fearful altitude. The guides were panic-stricken and helpless. For some time they could only shriek hysterically, "We are lost; we are lost." Neither could find courage to move a foot up or down.

For half an hour they remained in this perilous position, when one of the guides found courage to change his footing to a rock and fix a rope so that all three could descend to a safer place. The guides were so completely unnerved that they could give little or no assistance to Whymper, and were indeed scarcely able to care for themselves. Again and again the guides looked below them and, shrinking back, declared, "I cannot; I cannot." Whymper forced them to proceed, so that they repeat-

edly turned to him and begged for delay and even demanded if he meant to kill them and himself. On reaching an easier grade the three men tore down the cliff at a mad pace, so that it is surprising that they ever reached the foot of the mountain in safety. At nightfall they continued in the darkness to descend until, almost exhausted, they were forced to look about them for shelter. A stone was discovered just large enough to hold the three, and here the men huddled against the cold and wind through six hours of darkness.

Early next morning the three hurried on to Zermatt. They were met by friends ready to celebrate their victory. Whymper announced the tragedy by merely saying, "The Taugwalders"—the two guides—"and I have returned." Their friends burst into tears.

A relief party was quickly organized and hurried to the plateau upon which the bodies had fallen. After hours of perilous climbing they came within sight of the plateau, where the bodies were soon discovered. Each member of the relief party examined them with the aid of a strong glass; each turned deadly pale as he looked, and without a word handed

the glass to the next. All hope was gone.

The tragedy naturally attracted wide attention throughout Europe and was brought before a court of inquiry in Zermatt. With proper precaution the accident should not have occurred; a few moments after the tragedy Whymper examined the rope that had broken and was horror-stricken to find that it was an old piece that had been brought along as a reserve and was never intended to be used for this purpose.

The party had three new ropes that had not been used. The nature of the break in the rope also aroused much discussion. The guide was roundly accused of having cut the rope to save himself. It was also suggested that the guide had purposely used the weak rope to tie himself to the next in line, so that in case of a fall he might escape being dragged down.

Led by Jean Antoine Carrel, the Italian party meanwhile had made a brave fight to conquer the Matterhorn by way of the precipitous slopes on the Italian side of the mountain. They were well up on the mountain when Whymper succeeded in passing them and reaching the goal. Two days later the Italians

also reached the summit. The heroic efforts of the Italians must always be remembered in the history of the mountain.

Carrel met a tragic end in a subsequent effort at the Matterhorn. He and his companions had reached a small shelter below the great tower when they were cut off by a severe storm. The Italian was then in his sixty-second year. The storm continued for two days and two nights, when the food and firewood of the party was exhausted. They finally decided to make a last effort. Ropes had been fixed to assist them, but these were so covered with snow and ice as to be useless. The party had almost reached safety when Carrel's strength was exhausted. "I have no more power left," he exclaimed, and fell in the snow. Through the rifts of the driving snowstorm it was impossible to see the quiet green fields below them. The party was cut off from all assistance, and the famous mountaineer, urging his comrades to save themselves, died in the snow.

Many tragedies have since occurred on the Matterhorn through failure to take obvious precautions. The accident on the Zermatt

ridge in which W. O. Mosely of Boston lost his life is typical. Mosely accompanied by two guides attempted the ascent in August, 1870. He untied the rope around his waist, and attempted the ascent without this safeguard. It was discovered later that the American climber wore shoes wholly unsuited to the purpose. He was jumping across a rocky ridge when he slipped and fell down a precipice more than two thousand feet in height. The scene of the tragedy has since been known as the Mosely Platt.

To-day the rugged precipitous sides of the Matterhorn have been robbed of much of their danger. The tourist ascends to the summit by easy stages, stopping for rest and refreshment at a series of stone huts amply provisioned and supplied with the necessary mountain-climbing equipment. The ascent is frequently made without guides, although not without the assistance of porters. The early pioneers who struggled through these lonely regions would have marveled at the conveniences at the disposal of the climber to-day.

About three thousand feet above Zermatt now stands the Schwarts Hotel, where every

comfort of travel may be enjoyed. A two hours' climb from the hotel brings one to the Alpine Club hut on the Hornli Ridge looking down on Zermatt. This convenient station stands at the very foot of the great pyramid-shaped peak of the Matterhorn itself. A stiff climb of five thousand feet more brings one to the Matterhorn Hut. By making an early start from this shelter, preferably just before dawn, the summit may be reached with good luck early in the day.

Still another hut is discovered further up, where a stop may be made for another breakfast. There are several well defined trails above this point up the shoulder of the mountain. This shoulder in turn joins the steep face of the final peak. The trail in this region is supplied with a series of fixed ropes and chains for the convenience and safety of climbers. The seasoned mountaineer scorns these safeguards. To-day about one hundred climbers succeed in reaching the summit of the Matterhorn every season.

It frequently happens that the most successful mountain climbers fail to do themselves justice in describing their experiences. There

are, of course, notable exceptions to this rule, and the layman is therefore especially indebted to them, since their narratives make it possible to share their experiences. A notable example may be found in the description of climbs in Alpine peaks by a skilful mountaineer, Abate Achille Ratti, who later became Pope Pius XI. He enjoyed a wide experience in mountain climbing about the year 1889, which he described in detail in the journal of the Italian Alpine Club and later in his book, "Climbs on Alpine Peaks."

The experiences of the pope in ascending the Matterhorn are especially interesting. In his first attempt the party was driven back to Zermatt by bad weather. The next day a start was made at 2 A. M., and the new hut was reached at 4:15, which indicates good climbing. Here people were met coming from the Matterhorn who reported bad weather, but the Italians, undismayed, pushed on. They soon passed the dangerous slopes of which Whymper had warned climbers. The pope remarks that the famous eastern face of the Matterhorn, which appears to be so impossible from

Zermatt, presented no difficulty for a good climber. The topmost peak of the Matterhorn was reached at 4:30 P. M.

The hour was late to attempt a descent of the Matterhorn, and the snow was coated with a varnish-like top covering of ice. The climbers were securely roped, and only one of them moved at a time, the others holding the rope tight, firmly placed on the mountain-side. The party happily reached the base in safety. The pope in his reference to the great mountain is especially happy; he speaks of "the singular form of the Matterhorn, the perfect isolation in which its gigantic peak is thrust through the air into the heaven."

The dramatic history of the Matterhorn may be fittingly closed with the words of Edward Whymper, who wrote, bidding it farewell:

"It proved to be a stubborn foe, it resisted long, and gave many a hard blow, it was defeated at last with an ease which none could have anticipated, but, like a relentless enemy, conquered but not crushed, it took terrible vengeance. The time may come when the Matterhorn shall have passed away and nothing save

shapeless fragments will mark the spot where the great mountain stood, for atom by atom, inch by inch, yard by yard, it yields to forces which nothing can withstand."

CHAPTER IX

CLIMBING AT HOME

IT comes as a surprise for many to learn that the Rocky Mountains are vastly greater in extent than the Alps, scattered as they are throughout Europe. The Alps bulk largely in the imagination because of their historic associations and from having been the scene of immense activity in mountain climbing. For a century they have enjoyed surprising publicity. The Rocky Mountains are acquiring this human element and, more and more every year, are coming into their own. Just as the mountain climbers have tirelessly explored the Swiss, French, and Italian Alps for more than a century, new generations of mountaineers are revealing the beauties, as yet scarcely suspected, of our own mountains at home. It is the old story of the prophet in his own country.

The more obvious physical features of the Rocky Mountains in the United States have

been definitely explored and mapped. The first observations of many of the highest mountains the world over have often been made by mountain climbers, while government surveys have followed later to correct and confirm them. In the case of the Rockies this order has been reversed. So far the exploration of the sportsman in these regions has been much less considerable than the systematic work of the government surveyors.

An immense amount of exploration remains to be done throughout the Rockies by intelligent and sympathetic mountaineers. The innumerable ranges of mountain peaks, extending from Mexico northward, offer a limitless field for such activities. Throughout this region paths will be made, trails cut through mountain wildernesses, the mountain peaks, valleys, and glaciers explored and photographed, and detailed maps prepared. An invaluable service, meanwhile, has been performed by the Government in establishing National Parks that will preserve the show places of these great ranges for all time. The best features of the mountain resorts of other countries have been borrowed and often im-

proved upon for the convenience of those visiting the Rockies.

The Rocky Mountains were the first great range of mountains in America to be discovered. Nearly three centuries ago, when the Atlantic coast was populated by a few scattered colonies, a party of Spaniards including Alvar Cabeza de Vaca traveled northward from the Gulf of Mexico to the Spanish settlements on the Pacific coast, crossing the southern Rockies. A century and a half passed before the mountains were again visited, when two French brothers named La Virendrye crossed the continent from the Great Lakes to the source of the Yellowstone River, and therefore were the first to see the northern ranges. The names of later explorers of the Rockies are familiar, notably Lewis and Clarke, Pike, Long, and Frémont, whose names have been taken by the higher peaks.

The northern region of the Rockies comprise several great ranges, roughly parallel, which spread out to a width in some places of four hundred miles. In Montana and Wyoming alone there are scores of peaks rising to from ten thousand to thirteen thousand feet. Two

great ranges enter Colorado, the Medicine Mountains toward the east and the Park Range on the west. The Front Range, which rises abruptly to great heights in northern Colorado, includes the lofty summits of Hagues Peak (13,832 feet), Longs Peak (14,271 feet), and further south Pikes Peak (14,147 feet). Through a break in the chain flows the Arkansas River, while beyond, the ranges, rising to great heights, extend southward.

One of the most impressive regions in the northern region of Colorado, comprising more than a quarter of a million acres, has been incorporated into the Rocky Mountain National Park. It has an elevation of eight thousand feet above sea-level, while many of its peaks rise to twelve thousand feet, and several, including Longs Peak, rise more than fourteen thousand feet. Here the climber of mountains will find elaborate preparations made for his comfort. He may make his base at the foot of the mountains in hotels that compare favorably with any in the Alps, and countless trails beckon him towards the higher peaks.

The opportunities afforded for making the ascent of Longs Peak are not generally appre-

ciated. It has been called with reason the American Matterhorn. Its elevation is but five hundred feet less than that of its famous Swiss counterpart, and like it one of its faces appears to be quite inaccessible. The contour of the peak, suggesting a great citadel protected by ramparts of formidable rock, offers a splendid opportunity for climbing. It will be recalled that the famous eastern face of the Matterhorn, first scaled by Whymper, proved to have an ascent of forty degrees. On no part of the eastern face of the Matterhorn is there a vertical surface more than five hundred feet in height. Longs Peak has a sheer wall rising for seventeen hundred feet. The summit of Longs Peak, a large flat surface covered with slabs of granite, commands an incomparable view of the surrounding ranges.

Pikes Peak attracts many thousands of visitors every year. It is one of the great Rampart Range, which includes in an area of about five hundred square miles forty-two of the forty-five mountains in the United States that exceed fourteen thousand feet in altitude. Among the other familiar peaks of this region are Mount Massive, Mount Elbert, and the

Holy Cross. Pikes Peak was first climbed by E. James and his party in 1820, a century ago —a very early date in the history of mountain climbing in America.

The peak is extremely accessible, rising as it does but six miles from Colorado Springs. Every preparation has been made for the convenience of mountaineers, both amateurs and professional. The more venturesome may make the ascent by foot. Others will prefer to go up on horse- or mule-back. For the more luxuriously inclined there are excellent automobile roads. The easy-chair mountaineer also has a cog-railroad at his disposal.

Probably no other great snow peak in the world is visible to so large a permanent population to-day as Mount Rainier, or Mount Tacoma, as it is otherwise called. To the population of more than one thousand square miles it is a familiar daily spectacle. It has been a very happy idea to preserve the mountain and its beautiful approaches for all time in the National Park which bears its name. Its incomparable scenery is therefore enjoyed by thousands of visitors every year. Every preparation known to modern moun-

taineering has been made for scaling its sides, and the number making the ascent increases from year to year. Rainier, incidentally, is the only mountain in the world to-day where women guides are available to assist parties that include women.

The conquest of Rainier demanded consummate skill in climbing and extraordinary powers of endurance. Mount Rainier, originally known as Tacoma, or some variant of the word, was observed as early as 1821, although it was not climbed until 1870. Like the great peaks of Switzerland and of Asia the superstitious fears of those living about its base long protected its summit from an assault. The Indian tribes living in its vicinity were convinced that an awful being lived at its summit who would punish intruders.

Mount Rainier was first climbed by General Hazard Stevens in 1870. The journey to its base at that time required a long march of many days over very difficult country. Elaborate preparations were made, and the equipment, which included scientific apparatus for making observations, was carried in the early stages on horseback. It was a formidable cav-

alcade that finally took the road, or rather the Indian trail, that was then the only approach. The trail soon grew very dim and was crossed by so many others that it became of doubtful value and was repeatedly lost. The party crossed much intricate country, struggling through thick forests and wading glacial rivers.

When the trail became too rough for the horses the provisions were carried in packs. The mountaineers depended largely upon their rifles for meat. The snow-line was finally reached, and then the struggle was on in earnest. The snow-slopes proved to be very steep, and the rock climbing was especially arduous. It was necessary on these slopes to creep laboriously upward on hands and knees, clinging to scanty tufts of grass for support. On looking down it seemed incredible to the climbers that they had ascended the mountain side at such an angle.

The highest crest of the intervening range was reached in safety. The great snow dome of Rainier appeared in the clear air to be but two miles away, although it was in fact more than twenty. From this point of view Rainier

appeared extremely formidable. The snow-covered peak rose high above the clouds. Its sides appeared to be absolutely vertical, with great walls of black rock rising for a full third of its altitude. The party following a direct trail now, descended for fifteen hundred feet into the intervening valley, and pushed rapidly forward.

At first the course lay across broad snow-fields and later over steep slopes of loose rolling stone, which turned underfoot, rendering the progress very slow. The upper snow-slopes when reached were found to be very steep. The face of the mountain that had to be crossed proved exceedingly treacherous. A deep abyss fell away abruptly on one side, and the slopes were frequently swept by avalanches. At this altitude the wind blew with hurricane force.

Until this point was reached the Indian guide, heavily bribed, had continued to lead the party. On attacking the actual slopes of Rainier he refused to go farther, and no argument or money could shake him. The Indian repeated the ancient superstitions of his tribe that Rainier was an enchanted mountain inhabited by evil spirits who dwelt in a fiery lake

at its summit. The American Indian had never heard of the Swiss Alps or the Himalayas, but his belief in the mountain spirits was almost identical with that of the Swiss peasant of a century ago or of the East Indian of to-day. The Indian finally offered to wait three days for the return of the party, when he would return to civilization and report their loss. He spent the rest of the night chanting a dismal dirge in anticipation of the death of the climbers.

After mounting the lower slopes, the party camped in the snow for the night. A start was made at daybreak on the following morning, August 17, 1870. Securely roped, and with the vigorous use of the ice-ax, the party now ascended the steep rocky ridge that formed the backbone of this part of the mountain, rising at forty-five degrees. Next came a narrow saddle faced by a two-thousand-foot precipice. The party crawled cautiously over this, for the rock was obviously rotten. Many large rocks were loosened by the merest touch. At several points the great snow-field of the dome actually overhung them and from time to time broke off with a terrifying report. A great deal of stone also fell from above, which

kept them constantly on the alert to dodge the attack.

A steep ice-slope was now ascended by first laboriously cutting steps in the ice. At the top of this slope the ice was fortunately found to be corrugated like a rippling sea suddenly crystallized, and secure footing was assured. The rare atmosphere was giving the climbers serious trouble. The cold was intensified by a tempest of wind, so that the climbers had to seek shelter every few feet behind the rocks. The way led along the crest of a dizzy ridge, and the party presently found themselves on the highest point of the crest. The American flag was unfurled, and the climbers, standing erect in the face of the gale, with great enthusiasm gave three cheers. The middle peak of Rainier, which seemed higher still, rose beyond them. The intervening valley was crossed, and the final summit climbed.

On this slope the wind was laden with unmistakable fumes of sulphur. On investigation, jets of steam issuing from crevices in the rocks were discovered. The climbers warmed themselves beside the crevices so conveniently placed and, with their energy thus renewed, at

last reached the summit. They were thus the first to discover the great crater about six hundred feet in diameter at the summit, once a seething mass of lava, and now filled with the eternal snows. Through all the struggles of the ascent the climbers had carried a brass plate inscribed with their names, and after placing this in a deep cleft of the rocks they descended.

The ice-walls of the upper slopes of Mount Rainier were the scene of a distressing tragedy in 1897. The most daring feats of climbing on the face of Rainier, as on many mountains, have often been attempted by scientists in the pursuit of data rather than the mere spirit of adventure. The expedition of 1897 had made elaborate preparations in advance for taking topographical observations on the mountain. Professor Edgar McClure of the University of Oregon had been placed in charge of the elevation department. The great ambition of the party was to determine accurately past all dispute the exact height of Rainier, which was still in doubt.

Professor McClure had made elaborate preparation to assure correct observations. He

had prepared the mercury used in the barometer by special distillation, while the vacuum of the tubes was especially perfect. The readings made under such favorable conditions promised to fix the exact height of Rainier for all time. The party had reached a great elevation and were proceeding along a very dangerous trail with Professor McClure, carrying the barometer, in the lead. He had climbed to a precarious position ahead of his party but discovered its danger too late to retreat. He turned to the party and shouted a warning: "Don't come up here. It's too steep." In the act of shouting he lost his balance and fell to his death. The scientific observations he had already made were afterward worked out by others and proved of great value. It is suggested that a monument be erected in the remote ridge where he met his death.

To-day Mount Rainier is doubtless the most accessible of the great snow peaks. It may be reached from Tacoma or Seattle by trains, automobile, or stage in a single day. The last stages of the journey to the mountain are usually covered by wagon or pony. Many prefer a very deliberate approach with long halts

at the camps along trails to afford time for fishing. For the more luxuriously inclined there is an excellent hotel kept open throughout the climbing season. The snow-line may be reached in a few hours from the resorts.

It is generally supposed that one cannot enjoy glacial scenery without visiting Switzerland. The slopes of Mount Rainier are traversed by many glaciers, which lend a characteristic note to the mountain scenery and give the mountaineer plenty of vigorous exercise. Rainier's glaciers cover nearly fifty square miles, while many of its ice-streams are six miles in length. The glaciers flow down from the summit and radiate like the points of a starfish. From every point of approach the great masses of snow and ice serve to diversify the scenery.

The summit of Mount Rainier is visited every season by hundreds of tourists. Every possible approach has been definitely mapped; and the conditions to be expected according to the season, even according to the hours of the day, have been studied in detail. The preparations made for climbers are a triumph of the art of mountaineering. The dangers and diffi-

culties that General Stevens faced in the first ascent have been reduced to a minimum. The climbers bound for the top usually leave camp, under the direction of skilful guides, at 1 A. M., and, climbing according to a definite schedule, reach the summit by noon. Several hours are available for enjoying the marvelous panorama spread beneath. On the return, camp is usually reached by 7 P. M.

In addition to being the most accessible of the great snow-peaks, Mount Rainier makes a special appeal to mountain climbers because of its extensive steam-heating equipment. Although Mount Rainier is a volcano, its crater has long been inactive. The great bowl-like formation is filled with ice and snows. There still remain deep fissures in the rock that extend far down into the heart of the mountain. The snow fills the crevices and on melting flows down until it reaches the internal heat of the mountain, where it quickly boils and reascends in the form of steam. There is no opening in the crater large enough to fall into. Many parts of the crater have a temperature at times of 150 degrees Fahrenheit. At this elevation water will boil in a few minutes.

Where else can the mountain climber find an imposing mountain, ice-clad from head to foot, which is readily accessible, and whose summit offers the unheard-of luxury of steam heat?

In this general region a number of imposing mountains are to be found, all more or less accessible. The altitudes of the higher peaks of the group are as follows:

Mount Rainier	14,408 feet
Mount Shasta	14,408 "
Mount Adams	12,307 "
Mount Hood	11,307 "
Mount St. Helena	9,697 "

No description of mountain climbing in America would be complete which does not mention the activities of the various tramp and trail clubs throughout the country. Although these organizations are not, strictly speaking, associations of mountain climbers, if we count the perpendicular distance they traverse they undoubtedly qualify in following remote trails and in their enthusiasm for such adventure. There are to-day about fifty clubs regularly organized and actively engaged in carrying out these expeditions.

Definite plans have been made by these organizations in the eastern States to unify the trails already in existence throughout the Appalachian Mountains and to construct new paths to form a continuous route from end to end of the great mountain system. Starting with Mount Washington in New Hampshire, the Appalachian Trail, as it is to be known, will extend to Mount Mitchell in the Carolina highlands. Throughout the New England region mountain trails totaling 2008 miles have already been cut, and gratifying progress has been made in several other regions. In years to come the beauties of our great mountain ranges may be enjoyed from many thousands of miles of path and trail that will be readily accessible from various centers of population.

CHAPTER X

THE ALASKAN RANGES

BY the purchase of the vast unknown Territory of Alaska the United States unconsciously acquired one of the most remarkable regions for mountain exploration in the world. That this remote arctic land of ice and snow would some day become a Mecca for mountain climbers doubtless never entered the minds of those who arranged the purchase. For years after its acquisition the price of six million dollars was considered by many to be very exorbitant. The gold and other mineral wealth taken from Alaska later on, however, paid enormous dividends upon the investment. Since the possibilities of mountain work in this region have come to be realized, enthusiastic mountain climbers have come to consider the territory very cheap at the price.

Alaska includes several of the highest mountain peaks on the continent. It has the only

active volcano in North America outside of Mexico. Its glaciers and snow-fields are by far the most extensive on the western hemisphere, excepting only Greenland. Here are to be found innumerable unscaled mountain peaks ranging from ten thousand to twenty thousand feet in height, rising in high relief above rugged snow-covered ranges and narrow steep-walled valleys. Its mountains are among the "youngest" in the world, since they still show little evidence of destruction from erosion by water and ice, and they offer a fascinating field for exploration and discovery.

The world is largely indebted to those who have already climbed these mountain ranges for its knowledge of their remarkable history. On many long, laborious journeys the mountaineers have examined their formation from many points of view and have carried back rock specimens to be analyzed and classified. The remarkable history of the Alaskan range may therefore be written to-day with reasonable accuracy. The Rocky Mountains form one of the longest ranges in the world, extending through our northern States, Canada, and Alaska for a distance of about six thou-

sand miles, with a width in many regions of more than sixty miles. The long, deliberate process by which the mountains have been formed has therefore been carried out here upon a prodigious scale.

A great valley once extended over the general region from which the Rockies now rise. Nature selected this long depression millions of years ago for a place to build a mountain range; she began by slowly depositing on the valley an immense volume of sediment which was washed down from the sides of mountains that were then rising on either side, or which was carried by rivers and small streams often from considerable distances. The process began in very remote geological times, and continued with infinite deliberation for millions of years. The material thus carried into the great valley came in time to be measured by thousands of cubic miles.

Originally this deposit was several miles in depth. It was, besides, of a mixed nature, including great masses of rock of many varieties. There were, besides, enormous deposits of sand and earth. In the course of millions of years this material gradually solidified

AT THE ULTIMATE SUMMITS OF TWO ALPINE PEAKS

CLIMBING AN EASY SNOW SLOPE IN THE ALPS

until it formed a mass about twenty thousand feet thick. The process was, of course, infinitely slow, since great mountain ranges in the vicinity had to be gradually worn away and to disappear to form the basic material for the new range. The Alps, as we have already seen, are to-day merely the stumps of a great mountain range which once rose to a much greater altitude; millions of years have been required to wear them down to their present level, high as they now appear to us. It will take many millions of years more to wear them down to the level of the surrounding regions. It was by such a process that the mountains throughout the northwest of North America were worn down to form the rough material for the present ranges.

From this great plateau thousands of miles in length the present great range of Rocky Mountains gradually rose. Little of the work was performed by volcanic action. The upheaval was very gradual. The uplift was probably caused by the gradual shrinking of the earth's interior by reason of the loss of heat. The thrust came from far below the surface and finally affected the crust, which rose

a few feet at a time. The new mountain ranges therefore rose roughly parallel to those which had originally occupied this region.

The immensely varied character of the Rockies is, of course, due to the fact that the floor of the valley from which they rose was made of extremely heterogeneous material, while the force that uplifted them was exerted from many directions. In many places, it is believed, the mountains may still be rising, uplifted by these mysterious internal forces. The process is obviously so slow, however, that many centuries must pass before the most careful readings of altitudes need be corrected.

Despite the expeditions, official and private, which have explored Alaska, most of its mountains are still little known. Only the highest peaks along the coast have so far been visited. Generations of mountain climbers will continue to find here a virgin field for their efforts. Every problem in mountain climbing seems to be offered in bewildering variety. The deep fiords penetrate far into the coast range, and great walls of stone often rise abruptly from tide-water. Broad rolling uplands extend inward to the higher peaks. Many of the moun-

tains are thus readily accessible from the coast, while others by their remoteness tempt the mountain adventurers.

The first of these peaks to be scaled was Mount St. Elias (18,024 feet), which was conquered only after a number of attempts extending over fourteen years. Twenty miles further inland stands Mount Logan (19,539 feet), still tempting the mountain climber. At this writing even its slopes have not been visited. Just west of Mount St. Elias lies a great group of unexplored mountains, one peak at least being over fifteen thousand feet in height.

Among the high mountains that are still unclimbed are Mount Vancouver (16,676 feet), Mount Hubbard (14,950 feet), and Mount Cook (13,755 feet). The highest mountain of Alaska and of North America, McKinley (20,300 feet), has been conquered. Here is a group of mountains overtopping the Alps, many of whose peaks, over regions hundreds of miles in extent, have not as yet even been named.

The grandeur of the Alaskan glaciers is curiously unfamiliar even in America. Among the coastal ranges of the Pacific there are alone

more than twenty thousand square miles of ice- and snow-fields. Throughout Alaska the glaciers form the most striking features of the landscape. On the Pacific slopes these mountains of ice break down to the sea in formidable cliffs, which separate, forming huge icebergs. The largest of these ice-fields and snow reservoirs overlays part of the St. Elias range, where more than ten thousand square miles are buried under perpetual ice that rises to an altitude of from five thousand to ten thousand feet. The sea of ice pours downward through the gaps and valleys of the mountains, presenting an unrivaled spectacle.

A vivid picture of this remote region is given by Russell, who looked down upon it from Mount St. Elias: "A vast snow-covered region limitless in expanse, through which hundreds and probably thousands of barren angular peaks project. There was not a stream, not a lake, not a vestige of vegetation in sight. A more desolate or utterly lifeless land one never beheld. Vast smooth ranges without crevasses or breaks stretched away to seemingly limitless distance, diversified only by jagged and regular mountains."

Mount St. Elias was discovered and named nearly two centuries ago and is therefore in a sense the oldest mountain in America. When Vitus Bering discovered this part of the North American continent in 1741, he observed the high snow-capped mountain from far at sea. His entry in the ship's log is still preserved. "The land at this place," he writes, "is very lofty and a range of mountains was observed of such altitude that it could be seen sixteen Holland miles from the shore"—the peak has since been sighted from a point two hundred miles offshore. The mountain soon came to be used as a natural landmark and an international boundary.

About forty years later it was again reported, this time by the British explorer Captain James Cook, not to be confused with Dr. Frederick A. Cook of arctic fame. Several nations later sent expeditions to this region, and all were much impressed by the great snow-peak that dominated the coast. Before Alaska was transferred to the United States in 1867 all the mountain ranges visible from the sea had been at least outlined, but the interior remained virtually an unknown country. Di-

rectly after the transfer the United States Coast and Geodetic Survey attacked the problem, but no systematic survey was made of the remote regions for a generation.

The famous gold rush to Alaska, after the discovery of gold in 1898, may be said to have literally put Alaska, or much of its interior, on the map. More than fifty thousand people went into this little known region. There followed immediately an urgent demand for maps of the country and incidentally of its mountains, and several departments of the Government took up the work. In an incredibly short time about one fourth of the total area of Alaska, had been surveyed and mapped. Extended contour maps were prepared, including that of the St. Elias range which has proved of valuable assistance to mountain climbers.

Alaskan mountaineering is of comparatively recent date. Although Mount St. Elias was discovered in 1741, the region for many reasons remained so inaccessible that the first attempt to climb its peak was not made until 1886. It was believed to be the highest peak in Alaska if not in all America, and therefore held a great fascination for mountain climb-

ers. The first party to attack St. Elias was international in character, and included Lieutenant F. S. Schwatka, U. S. A., Professor William Libby of Princeton, and Lieutenant Seaton-Karr of the British army.

The members of the party landed at the mouth of the Yaktse River, but were handicapped from the first by their ignorance of the country before them. They succeeded after two weeks in reaching a point only sixteen miles from the coast at an altitude of about seven thousand feet, when they were obliged to turn back. The data collected about this region proved to be of great value to other expeditions. Two years later a second expedition succeeded in ascending Mount St. Elias to an elevation of 11,400 feet. A third unsuccessful attempt was made in 1890. In this year the party was turned back for lack of food or fuel on the higher slopes. In 1891 the Russell expedition succeeded in reaching an altitude of 14,500 feet, and would doubtless have got to the summit but for a severe storm.

The observations of the glaciers and the maps prepared of the upper slopes were considered ample recompense for the effort. Rus-

sell estimated that Mount St. Elias had an altitude of 18,100 feet, which proved to be remarkably accurate: in 1922 the Coast and Geodetic Survey found the elevation to be 18,924 feet.

After so many failures to carry the American flag to the summit of Mount St. Elias, it was in the end the Italian flag that first was planted on the uppermost peak. The Duke of the Abruzzi attacked the mountain with a large, well-equipped expedition in 1897. It was generally recognized at the time that the conquest of St. Elias would be a great achievement, and many mountain climbers in Europe as well as in America planned to capture the prize. An American expedition was reported to be on the way.

The Italian party realized that not a day was to be lost. Preparations were made from Italy by cable, and the duke and his party moved with great despatch. The Atlantic was crossed on the fastest steamer in the service, the *Lusitania,* and on arriving at New York the party spent but three hours before starting for the Pacific coast. They finally reached

Alaska to find that the American party was two weeks ahead of them.

In the record of this expedition, as it was published subsequently, great stress is laid upon the preliminary difficulties in crossing the glacier and ice-fields that form the approach to Mount St. Elias. It is pointed out that the snow-line in Alaska descends as low as twenty-five hundred feet. The low snow-line necessitated a climb of fourteen thousand feet, all of which was snow work. In the Alps, for instance, the snow-line is so high that the forest extends far up the mountain-sides, and the climb above the snow may usually be done in a single day. After leaving the forests nearest St. Elias a journey of nearly sixty miles was necessary to reach the actual approach to its summit. St. Elias is therefore one of the great climbs of the world.

The Italian party was soon under way. It first passed to the western end of the range, crossed the Tyndall Glacier, and began the ascent of the great slope. A halt was made at an elevation of 5800 feet, when one of the party turned back. The next stop was not made un-

til an altitude of 7200 feet had been reached, which was sixteen miles from the coast. The last stage of the ascent was commenced on July 30. The party was called at 1 A. M., and it was hoped that the summit might be reached the following morning.

One of the secrets of the success of the expedition will doubtless be found in the completeness of its equipment. For the final rush for the peak the equipment included two Whymper tents, ten sleeping-bags, rations for two and a half days, a portable cook-stove, a spirit-lamp, and the meteorological instruments. Three porters carried the equipment on the final dash.

The snow at first was found very firm underfoot, and considerable elevation was won. Later, the party came upon a rocky face of surprising steepness overlapped by a heavy ice coating. The steep slope was covered with "avalanche snow," which threatened to give way at any moment. The angle of the slope, moreover, continued to increase. The top of the cliff was finally reached, and then the real difficulty began. A bad crevasse was encountered, and crossed by a precarious snow bridge.

The first in line had got across safely when the precarious support fell. The rest of the party finally crossed the crevasse by leaping across a wide opening above an abyss hundreds of feet in depth. By ten o'clock in the morning the top of the col was reached. Camp was pitched at 12,397 feet, and the party waited for another day.

Camp was broken up at midnight. The men were now carefully roped and the equipment reduced only to absolute essentials. Rations were carried to last but a single day. The crest of the col was now discovered to be an ice-cliff, and over this the climbers mounted steadily higher. After several hours of this strenuous climbing they were rewarded by a magnificent spectacle when the rising sun gilded the summit of St. Elias high above them. The altitude was now 15,700 feet. The next observation showed them they had reached 16,500, and a little later they discovered that they had passed the altitude of Mont Blanc. This was wonderful progress, and every nerve was now strained for the final effort.

Every slope now climbed promised to be the

last. Again and again they were disappointed. The pace meanwhile gradually slowed down. They would climb continuously with dogged determination for ten minutes, and then be forced to rest for five or six. At the end of one particularly long and difficult slope an ice pinnacle was suddenly disclosed above them. All cried at once, "The summit," but on reaching it still another slope stretched far ahead. Two guides led the party then in turn came the duke, with the others following some distance behind. Slope after slope was climbed until the task seemed interminable.

The high wind that swept these upper regions made it impossible for the climbers to talk to one another. They had thus been struggling forward in silence for hours, it seemed, when the two guides leading were seen to move suddenly aside and halt. The signal was instantly understood. The duke quickly moved forward, and a moment later stepped on the summit of St. Elias. The comment of the narrative is eloquent: it tells us that "every trace of fatigue disappeared."

The great altitude of Mount McKinley, our highest mountain, was not suspected until re-

cent years. As early as 1794 George Vancouver reported the discovery in the distance of two stupendous mountains crowned with snow and apparently detached from each other. The two peaks were later to become famous as Mount McKinley and Mount Foraker. They were explored after a fashion by a Russian expedition in 1834, but little knowledge was gained concerning them. An American expedition attempted an ascent in 1878 and ascended the rivers three hundred miles, but accomplished little.

Again in 1889 an attempt upon the mysterious peaks was made without success. Mount McKinley was originally called by the natives Denali and later Densmores Peak. It had, in all, five names before it appeared on any map. Up to this time it is probable that scarcely one hundred white men had ever seen Mount McKinley from a distance; certainly no one realized its great height.

The highest of our mountains was not finally named until 1896, when a mining engineer, W. A. Dickey, who was prospecting in this region, made the selection that has since been universally recognized. The height was then esti-

mated at twenty thousand feet. It was not until 1902 that the actual slopes of the mountain were reached by white men. The reports carried back from the early expeditions established its great altitude; they served to attract attention to Mount McKinley throughout the world, and a determined effort was now organized to conquer it.

The first man seriously to attempt Mount McKinley was James Wickersham, later a delegate to Congress from Alaska. He brought a unique experience to the task. Mr. Wickersham had been on the Mount Rainier expedition and for years had served as a judge in Alaska, where he was required to make long overland journeys in all extremes of weather. He succeeded in reaching an altitude of ten thousand feet. About three attempts were made later by Dr. Frederick A. Cook, of north pole fame. He attempted the ascent from two sides and in one attack reached a height of eleven thousand feet. In 1906 Dr. Cook once more organized a party, making the journey from the coast partly by a packtrain and partly by motor-boat, but in the end he failed in the actual climb.

A determined attempt was made in 1910. The party was organized at Fairbanks, and a base camp was established at the Muldron Glacier. In the dash for the top the party had climbed about five hundred feet when they were turned back. An attempt was now made on the north summit, and with better success: after facing many perils two of the party actually reached the summit. A remarkable feature of the climb was that despite the labor of climbing the precipitous slopes the party actually carried with them a flag-pole fourteen feet in length, which was to be planted at the top. The feat is doubtless unique in mountain climbing. The ultimate peak, however, still defied them.

One of the most heroic attempts in the history of mountain climbing was next made in 1912 by Professor Herschel Parker and Belmore Browne. They gained the upper slopes of McKinley with great effort, and had pushed on in the face of a severe blizzard within a short distance of the top. At an altitude of 16,600 feet, the highest altitude yet attained on McKinley, they were forced to turn about. Still another attempt by the same party failed.

The highest peak in America had repelled all attacks directed against it.

The repeated attempts and failures upon the highest peak in America had naturally attracted world-wide attention, and the race, as it may be called, was watched with lively interest. Probably not since the conquest of the Matterhorn had rivalry in such a race run so high or attracted such general attention. In the end the ascent was made as the result of long persistent effort in the face of great danger. A party was organized by Dr. Hudson Stuck, archdeacon of the Yukon, and H. P. Karstens of Fairbanks. They laid siege to the mountain, following an elaborate plan of attack. On reaching the actual slope the party ascended to an elevation of four thousand feet and pitched camp. An ascent was then made to a height of 11,500 feet. The party was almost buried at this point by an earthquake, which shook down immense avalanches of ice and snow upon them.

In the next dash an elevation of thirteen thousand feet was reached. So great were the difficulties that five days of hard climbing were required to ascend two thousand feet. The

highest camp was pitched at an altitude of seventeen thousand feet between the two summits. Some idea of the care with which the expedition was planned may be gained from the fact that provisions sufficient for three weeks were carried to the highest camp. Finally a favorable day dawned, and the party reached the ultimate summit of the highest mountain in North America.

CHAPTER XI

FIFTY SWITZERLANDS IN AMERICA

EVERY year the Alpine Club of Canada lays siege to a new unexplored mountain. Throughout Europe such a program has been impossible for a generation. Every problem that delights mountain climbers is encountered in America, usually on an inspiring scale. Although the history of mountain climbing in the Canadian Rockies covers but a few years, activity there has been remarkable. Tens of thousands of climbers, many coming from abroad, have made these ascents. Swiss mountain guides have been imported, and an elaborate system of trails, camps, and shelters has been constructed. There are said to be fifty Switzerlands in America, in point of opportunities for mountain climbing. The supply of virgin peaks seems to be inexhaustible.

It was not until 1888 that the history of mountaineering in this region was definitely

begun. In that year W. A. Green visited the Canadian Rockies, and he later published a book on his work that quickly attracted other climbers there. Two years later mountain climbers from the Swiss and English Alpine clubs and the Appalachian Mountain Club of Boston journeyed to the Rockies. A new section of the Appalachian Club was organized, and the American Alpine Club soon followed. In 1906 the Alpine Club of Canada was formed.

The most striking of the early attempts to climb the Rockies was made as recently as 1901 by Professor Charles E. Fay of the Appalachian Club. His first expedition was directed against Mount Goodsir. The foot of the topmost summit was reached, but the snow was found to be so treacherous that the party was obliged to descend. A second attempt was made two years later when the party included Professor Parker. Professor Fay has described his experiences graphically in the "Canadian Alpine Journal."

Camp was pitched at the base of the mountain, and a start was made at daybreak the following day. After a hard climb the party

reached the foot of a steep cliff that guarded the final peak. The cliff appeared from a distance to be impassable, but, on approaching, it was found that its face was covered by snow-patches that a skilful climber could use for stations. The rock face between these was so smooth that few projections could be found for footholds and handholds. The most daring kind of rock climbing was required to pass this barrier.

The summit of the cliff had finally been safely reached by all when a new difficulty brought them to a halt. Having solved the most difficult known problem in rock work, they must now face an equally baffling problem in snowcraft. Although the final summit was only about three hundred feet away, it was cut off by a precipice on one side and a seventy-degree snow-slope on the other. The snow covering this slope, meanwhile, was continually slipping forward, producing a curious hissing sound as though warning of danger.

A narrow cornice led across this slope to the summit, but no one dared venture his weight upon it. Even as the climbers watched the snow, debating if they ought to chance their

lives on so precarious a support, a great section suddenly gave way, and an avalanche was instantly in progress down the precipitous snow-slope. It rushed down for two thousand feet and plunged into space for three thousand feet more. The party retreated, and all attempts were given up for the season.

Two years later Dr. Fay returned to the attack. When the lower summit was reached the narrow ridge was found still in place, but this time the snow was stable. The ridge was so narrow that the men had to straddle it and work their way across with the utmost precaution. The climbers proceeded with one leg hanging over a sheer drop of thousands of feet where the wall of the precipice actually overhung. The other leg hung over a slope of seventy-six degrees. The summit was finally reached. The comments of successful mountain climbers on reaching their goals are usually interesting. Dr. Fay writes, "The repulse of two years was forgotten and our affections went out to the graceful peak, no longer a sullen monster, and, for the joys of that one glorious hour spent on its pure snowy summit we granted it our love for a lifetime."

The conquest of Mount Hungabee, which rises at the head of Paradise Valley, was accomplished in the same year by Professor Parker. Starting from Lake Louise, the party traversed the Valley of the Ten Peaks and crossed by a high pass into Prospectors Valley, where camp was pitched for the night. A start was made at 2:30 the next morning, and the foot of the mountain was reached in good time. Here the party was confronted by a vertical cliff broken only by a narrow chimney, which was filled with ice. One of the guides attempted to ascend it.

The first man up a rock chimney faces an appalling danger: if he falls there is no rope to save him. Professor Parker gives us a very real sense of the danger in his description of the venture. "It was only by watching the rope," he writes, "that we could judge the progress the guide was making above us. For minutes at a time it seemed the rope would be motionless, then inch by inch it would slowly disappear up the chimney, and the crash of falling ice and rock would warn us that we must cling even more closely and find what

protection we could beneath the rocky walls."

The guide reached the top, and with his help the rest of the party soon stood beside him. The top of the mountains was now but a few hundred feet beyond them, but the approach was over a smooth, steep slope. It was decided that the ridges that had to be crossed, broken as they were by vertical cliffs, were impossible. The steep snow-slope was the only other means of approaching the top. The party, moving with extreme caution, made their way beneath the cliffs and turned a corner whose slopes were so sheer that the climbers found themselves almost in midair looking down on Paradise Valley.

A perpendicular cliff was now discovered, which was in turn climbed by means of a crack in its face. The party now stood on the rocky ridge only a short distance from the coveted summit. But an unforeseen difficulty threatened to rob them of the fruit of their long labor. The sharp ridge they must cross was broken by a narrow break. It was only a few feet wide, but its walls fell away in a sheer descent of several thousand feet. The

narrow gulf must be crossed or the climb had been in vain. Professor Parker describes the next move in the ascent as follows:

> The arête or ridge was far too narrow to allow a jump being made with safety; so, slowly and carefully, while firmly grasping the rock on one side, the guide thrust his feet forward until they touched the other, and his body bridged the chasm. Then a strong forward swing and he stood safely beyond the gap. For me, aided by a rope, the matter was less difficult, and soon we made our way over the intervening arête, gained the corniced summit, and Hungabee, the grim old "Chieftain" at last was conquered.

Mount Assiniboine (11,800 ft.) was long considered unclimbable. Its bold contour, suggestive of the Matterhorn of K 2 of the Himalayas, seemed to present on every side a series of impossible faces. Similar problems in rock climbing are found elsewhere in America and Europe, but not upon so gigantic a scale. A skilful rock climber might contrive to stick upon a surface so nearly perpendicular for a short distance, but an upright face several

thousand feet high daunts the hardiest climber. K 2 is still unclimbed. It will be remembered that the Matterhorn remained unscaled for a half-century after the conquest of Mont Blanc, and for the same reason.

The Matterhorn of the Rockies seems to have been discovered in the early eighties. It must have been observed by the missionaries who passed this way in 1845, but there is no mention of it in their reports. It was not visited by white men until 1893, when American mountain climbers reached its base and returned to tell of its beauties. The first attempt to scale its sides was not made until two years later. The party proceeded through a virgin wilderness. Camp was first pitched on Healy Creek.

Two days later the party passed the continental divide. Although the ascent was made in July, snow twenty feet deep was encountered here. After the party had passed through much wild country the foot of the mountain was finally reached. Two weeks were now spent in making a complete circuit of Assiniboine, a journey of more than fifty

miles. Every face of the mountain was carefully studied, but all alike defied every attempt to scale them.

Another effort was made in 1899, and several members of the original party accompanied the expedition. Profiting by past experiences, the party selected a favorable approach and succeeded in climbing to an elevation of ten thousand feet. They might have reached the summit but severe storms drove them back. Two of the men in descending had a narrow escape on the abrupt face of the mountain. They were roped together, when one slipped and fell, dragging the other after him. The face of the mountain had been made treacherous by recent snows. In their fall one of the men chanced to slide over a projecting rock but succeeded by skilful use of his ice-ax in checking himself and swinging around into a narrow crevice free from snow. A moment later his companion was shot over his head, but was saved by the rope. Had they missed this obstacle a fall of more than a thousand feet would have been inevitable.

Further attempts to scale Assiniboine were soon made, and several climbers succeeded in

getting up considerably more than ten thousand feet, but none even approached the summit. After repeated failures the mountain came to be popularly considered unclimbable. It was not conquered until 1901, when Sir James Outram imported two Swiss guides for the purpose and again made the attempt. The chief danger encountered was in scaling the face of the great precipice that formed the sides of the mountain. At every step the climb demanded sure footing and quick judgment, when a mistake might have plunged the party to certain death. The summit was finally reached. Outram's description of his experience on the summit makes very interesting reading.

"One at a time, the other two securely anchored," he writes, "we crawled with the utmost caution to the actual highest point, an immense snow cornice, and peeped over the edge of the huge overhanging crest down the sheer wall to a great shining glacier 6000 feet or more below. Perched high upon our isolated pinnacle, fully 1500 feet above the loftiest peak for miles around, below us lay unfolded range after range of brown gray mountains patched

with snow and sometimes glaciers hung intersected by deep chasms or broad wooded valleys."

Like many other climbers who have ascended with comparative ease, Outram faced his most serious problems on coming down. His description of the descent across the precipitous face of the mountain affords a very vivid picture. "Well roped and moving generally one at a time," he writes, "we climbed downward foot by foot, now balancing on the narrow ledge 5,000 feet of space at our right hand, then scrambling down a broken wall end, the rock so friable that handhold after handhold had to be abandoned, and often half a dozen tested before a safe one could be found; now when the ridge became too jagged or too sheer, making our cautious way along a tiny ledge or down the face itself, clinging to the cold buttresses, our fingers clutching the scant projections of some icy knob, or digging into small interstices between the rocks; then an ice-slope had to be negotiated with laborious cutting of steps in the hard wall-like surface; and again cliff after cliff must be reconnoitered, its slippery upper run traversed until a cleft was

found and gymnastic descent effected to the ice-bound declivity that fell away beneath its base."

To-day every possible difficulty is smoothed away for the ascent of Mount Assiniboine. A trail has been prepared from Banff, the nearest point on the Canadian Pacific Railroad, forty-four miles away. Along this trail five rest-camps have been established at convenient intervals. Many tourists each season cover the distance on foot, arranging the day's walk to suit their taste. The plans for making the ascent are worked out in detail. Necessary supplies are available at strategic points. The actual climbing is directed by experienced Swiss guides, especially imported for the purpose. They make their home in a picturesque Swiss chalet especially built for them. Of the Alpine Club of Canada alone, thirty-five members last season succeeded in reaching the summit of Assiniboine; two of them were women.

By common and enthusiastic consent, Mount Robson enjoys the title of the "Monarch of the Rockies." It is at once the highest peak in the Canadian Rockies and, in the opinion of many, the most impressive. Robson stands at the

head of a great valley that supplies the foreground and middle distance of one of the most beautiful studies in mountain scenery in America. The lines of the summit are remarkably symmetrical, while the face rises from a river at its base a sheer ten thousand feet. The ultimate peak is more than thirteen thousand feet above sea-level. For many years the height of Mount Robson was grotesquely underestimated. The director of the Geological Survey of Canada, A. R. Selwyn, in an official report in 1871 estimated the height of the summit above the river at only two or three thousand feet.

Robson was not conquered until 1909, after two unsuccessful assaults had been made upon it. A stubborn fight of twenty days in the face of many disappointments was required to reach the top. The conquest was made by George Kinney and Donald Philips, who have described their experiences in detail in the "Alpine Club Journal." Each of the men was burdened with a fifty-pound pack strapped to his back. After ascending the rugged north shoulder of the mountain over a series of extremely difficult cliffs, they finally reached an

altitude of 10,500 feet. Everything promised well when a severe blizzard suddenly descended upon them, and they were forced to retreat over the ledges to their original base-camp.

The storm continued for three days and the unexpected delay brought their provisions dangerously low, so that they were obliged to live on marmot they caught in the snow. When the weather cleared, they started out again, this time attempting to scale the west shoulder of the mountain. "Here at an altitude equal to Mount Stevens," the narrative runs, "we chopped away a couple of feet of snow and ice and feathered our nest with dry slate stones. We shivered over the little fire that warmed our stew, and then, amid earth's grandest scenes, we went to bed with the sun and shivered through a wretched night."

The following morning dawned cold but clear. The blankets were rigged up to serve a wind-break, and behind this shelter a fire was kindled with a few sticks, and a simple meal was prepared. Undiscouraged by the experience, the men now resolutely started up the wet slope toward the upper peak. The snow was found to be in excellent condition for climbing.

The rocks where they lay bare of snow were exceedingly steep but offered nevertheless secure footing. Passing rapidly to the south over several ridges, the men at last reached the first of the two long cliffs that composed the formidable rampart that extends completely around the peak.

Up to this time the peak had been obscured by clouds, but the lower level had been clear. A strong wind now carried the clouds down the cliff and brought with them a heavy snowstorm. The slopes of the mountain in this region were so precipitous that a fall of snow meant an avalanche, and there was no point on the slope where one could be dodged. The climbers feared that their last chance of reaching the summit had passed. Their provisions had meanwhile fallen so low that a return to their base seemed imperative. Gazing into the blinding blizzard, Kinney declared sadly, "Curley, my heart is broken."

They had all but abandoned hope when the snow stopped falling and the clouds thinned. They decided to "make a rush" for the peak. The summit known as the little peak was directly above them. They were quickly afoot

and started directly upward, keeping as far as possible to the hard snow-slopes. These proved to be perilously steep, but the snow was in excellent condition for climbing. It was found possible by sticking the toes of their boots into the slopes to climb hand over hand directly up the face of the slope. Soon from the valley below a series of black thread-like lines appeared to cross the white face of the peak. These were in reality long ramparts or cliffs, which when reached presented a very formidable barrier.

The climbers now headed directly for the peak of the mountain, scaling a series of transverse cliffs or rocks. It was found that the faces of these cliffs were frequently broken and the crevices filled with snow, which offered fairly secure footing, thus making it possible to cross the rock face. The average angle of this face of the mountain is rather more than sixty degrees. It was often so steep for hundreds of feet at a time that as the climbers stood in the footholds the face of the mountain was not more than a foot and a half from their faces.

It was only at intervals that it was possible

to make footholds in the snow that enabled the climbers to rest by standing on their heels as well as their toes. Even then it was not safe thus to distribute their weight except by holding tightly to some projection on the face of the mountain. No place was found for hours when they could actually relax their muscles and rest even for a few moments at a time. In ascending the upper slopes the climbing work was done almost entirely with the aid of the toes and hands. A single slip would have meant a plunge down a fearful declivity to certain death. To add to their difficulties a storm beat upon them, shutting out all objects even a few feet away. They were alternately wet and frozen, so that their hair and clothing were at times a solid mass.

On reaching a point about five hundred feet from the summit the precipice was found to be ledged with a series of cliffs covered with snow that actually overhung the mountain-side. The snow at this altitude proved, besides, to be so dry that it crumbled at a touch and would not offer footing which would support the climbers. The men fought their way desperately up the last few feet of cliff and were

within reach of the top when a new difficulty faced them. The winds had driven the snow so that a huge cornice was formed fringing the crest of the peak. This barrier was so broad that it could be recognized ten miles away. The men floundered on, discovered an open way through the cornice, and finally emerged on the summit.

They found themselves standing on a needle-peak whose face descended at a dizzy angle for thousands of feet. It was possible to look straight down, through the hole they had cut in the cornices, upon the glacier below them. One often wonders what may be the comment of the mountain climbers on reaching a long sought goal; Kinney in his journal records his exact words. Looking out from this pinnacle he bared his head and said solemnly, "In the name of Almighty God, by whose strength I have climbed here, I capture this peak, Mount Robson, for my own country and for the Alpine Club of Canada."

For sheer daring in climbing precipitous rock faces the ascent of Pinnacle Mountain in Paradise Valley by J. W. A. Hickson is probably unrivaled. In the course of several un-

successful attempts on this peak it had been found that the summit was apparently cut off by a tower of stone whose sides were almost vertical. There were, however, two possible approaches. One was by way of a chimney in the rock-face, a narrow crack that had been attempted without success by other climbers. There was one other possible approach along a narrow ledge of rock on the mountain face, but the rock was in very bad condition. It was covered with ice, which made the footing precarious, while the rock handholds and footholds might give way at a touch. In Mr. Hickson's account of the adventure in the "Canadian Alpine Journal" he remarks that it was hard to say whether the rock sustained the ice or vice versa, and that the support, such as it was, was mutual.

The climbers started across this face very slowly, testing every support before chancing their weight upon it. So precarious were the footholds that they were even afraid to touch the projections with their ice-axes for fear of scaling them off from the mountain face. Every step must be taken with a catlike tread, since a sudden jar might loosen the rocks.

The guides examined each foothold in advance with an anxiety that may be imagined, for upon their judgment the party had literally at every step to risk their lives. Mr. Hickson found himself at one point astride a narrow rock, with a sheer drop on either side of two thousand feet, which might give way without warning at any moment. In some places there were no handholds on the face of the mountain, and the climbers had to balance themselves as best they could upon this extremely precarious ledge.

The party was roped with an allowance of twenty-five feet between each person, an unusual space in such work. This gave them more opportunity to manœuver into better positions on the rock-face. It requires unusually steady nerves to stand on the narrow cornice of a high building looking directly down on the street perhaps two hundred feet below. When such a feat is performed by a "human fly" great crowds collect to watch his progress. And the cornice is of course perfectly secure.

Now, imagine the drop from the cornice to be two thousand feet and the foothold likely at

any moment to drop away. Describing this climb across the perpendicular face of the mountain, Mr. Hickson observes: "We were glad when we found a piece of rock an inch or two wide and a few inches long, on a part of which a nailed boot edge could obtain a transitory grip. It is remarkable how very small a projection, if not slippery, will suffice for a temporary hold. Fortunately not one of the party once slipped, thus avoiding any test as to how far he could have been held by the others."

The party crept along this rock face almost horizontally for two hours. The nerves of all were continually on the stretch, since a moment's carelessness might mean a slip, and the fall of a single member might readily drag the entire party from their precarious perches. By a lucky chance the climbers now discovered a steep gully or gulch that led to the saddle between the black tower and the summit of the mountain. It was filled with ice and snow which offered secure footing. On reaching its end an easy slope was discovered, which ended only at the summit of the mountain.

So far, so good, but since it is commonly

more dangerous to descend than to climb a mountain the party had no appetite for more rock work. The guides were sent out to reconnoiter the tower from above. Let Mr. Hickson describe the next adventure in his own words:

The guides reported that we could get down by roping off. This led to one of the most interesting and exciting bits of the whole climb. At the corner or angle where the ledge terminated there was a peculiar arrangement of rock which had resulted in the formation of a small square hole with nothing but sky to be seen on the further side.

Under this hole there was a gap in the ledge of about three feet, with a drop of about fifteen feet into a dark pit beneath. To cross the gap it was necessary to lie down flat upon the ledge on the one side with face to the rock, stretch your feet to the rock on the other, your body thus spanning the gap, then draw yourself through the hole and gradually swing yourself into an upright position by the help of the rope and the handholds in the further wall of the rock.

The party at last managed to descend the side of the tower until when sixty feet above

its foot they were brought to a sudden halt. The only way to cover this distance was by roping off. The practice is, of course, common enough in both rock and snow work, but it requires a strong and steady hand. The rope was fastened above to a firm piece of rock, and each member was slowly lowered down the face of the mountain. The sensation of thus dangling in mid-air above an abyss might be trying to the layman, but it all comes in the day's work of the mountaineer. It is interesting, however, to learn just how it feels. "For the first forty feet," writes Mr. Hickson, "there were practically no footholds to be found, a fact for which we were prepared, but fortunately the rock was good, indeed this is the only piece of firm rock on the mountain, and I got down safely and out of the chimney, after swinging once or twice like a bundle of goods without any worse experience than having my clothes torn and with the feeling that there might be a permanent groove around the center of my body."

CHAPTER XII

CLIMBING IN DISTANT LANDS

FOR many years it was believed that the highest mountain in the world was to be found in South America. The highest point of the Andes, Aconcagua, overtops Mont Blanc by nearly five thousand feet. No definite figure was then available concerning the mountains of South America, and the Himalyas had not yet been surveyed. Several famous mountain climbers were therefore attracted to South America in the hope of gaining the distinction of conquering the highest of all peaks. The possibilities of scientific observation at such an altitude also served to attract several scientists, who made the long journey out from Europe for the purpose. This was all long before the days of steamships, and the voyage to America by sailing-vessel was a serious undertaking.

As early as 1802 Alexander von Humboldt

visited South America and attacked Mount Chimborazo, reaching an altitude of nineteen thousand feet. His work was so important, and the prestige of his name so great, that Chimborazo henceforth became one of the most famous mountains in the world. In 1831 another unsuccessful attempt was made upon it. It is probable that its upper slopes were reached by others, but the peak remained inaccessible.

The summit was first actually reached by the famous mountain climber Edward Whymper in 1880. Whymper had already gained world-wide celebrity as the conqueror of the Matterhorn. He brought from Europe two Swiss guides and attacked the peak in a very businesslike manner. He established three camps at altitudes of 14,375 feet, 16,425 feet, and 17,285 feet. The last stages of the ascent were rendered almost impossible, even for this veteran climber, by the depth of the loose snow. Whymper finally reached the topmost peak at an altitude of 20,498 feet. This was the highest point which had been attained by any climber in the world up to that time. Whymper ascended the peak a second time and

succeeded in climbing five other high mountains in the same general region.

Before leaving South America he ascended to the crater of an active volcano, Cotopaxi, and spent the night on the summit to carry out scientific investigations. He was anxious to make experiments with rarefied air at high altitudes and chose a mountain equipped with a natural heating-plant where he would be more comfortable for the purpose. The heat-supply was overdone, as a matter of fact, and one of the rubber tents that had been carried up for protection was melted.

The first attack on Aconcagua, the highest point of the Andes, was made by Paul Güssfeldt in 1883; but the attempt was doomed to failure because of lack of information concerning the geography of the region and of the difficulties which must be overcome. The great peak stands about ninety miles from the Pacific coast; it can be readily seen from Valparaiso, but the distance is deceptive. The mountain rises from a plateau surrounded by much intricate country. The same region includes Mercedario (22,000 feet) and Juncal (19,500 feet).

Dr. Güssfeldt was first accompanied by guides and helpers, but these broke down on reaching an altitude equal to that of Mont Blanc, and he was obliged to continue on alone. In eleven hours of climbing he succeeded in reaching the summit of a lesser peak in this region, Mount Marpo, whose altitude is 17,448 feet, a virgin peak. He next attacked Aconcagua. The enterprise was a severe test of nerves as well as of climbing ability. The region is exceedingly bleak and desolate, and the explorer was nearly a hundred miles from civilization. The only trace of human occupancy throughout the climb was the discovery of a skeleton high up on the mountain-side. The doctor was convinced that he was the first human being to pass beyond this point. A curious problem in mountaineering is met in this region. South of the equator the position of the sun is of course reversed, and shines from a northern sky. It is therefore the north side of the mountain which is freest from snow, a curious reversal of the general rule. The northern face of Aconcagua was therefore selected for the attack, despite its forbidding appearance.

MORAINE LAKE

[In the Valley of the Seven Peaks, Caradian Rockies]

ABBOTT PASS ABOVE LAKE LOUISE, CANADIAN ROCKIES

MT. TEMPLE AND SADDLE MOUNTAIN, CANADIAN ROCKIES

The start was made with three helpers. The party took no shelters with them. A halt was made at an altitude of 11,752 feet, and the night was spent on in the open snow of the mountain in severe cold. On reaching the base of the main peak, great black slopes of rock were found which appeared to be absolutely inaccessible. The party had now risen 16,500 feet, while the summit rose seven thousand feet above them. An attempt was made to reach the top with two Chilean porters, who were inexperienced in mountain work. With so heavy a handicap, failure was inevitable.

A much better organization visited South America in 1895 with the same objective. The party was led by E. A. Fitzgerald, accompanied by several experienced climbers. The intricate country surrounding Aconcagua was now better understood, and after a careful study of the geography of the region an entirely new approach was planned. On reaching the slopes of the main peak the trail crossed that followed by Dr. Güssfeldt, and the cairn he had built to mark his last position was discovered. A number of attempts were now made for the top, but the climbers were repeatedly forced to

turn back. Several of the party suffered severely from mountain sickness. It was planned to establish a permanent camp at twenty thousand feet, but the steepness of the slopes prevented.

The final dash was begun before daylight. All walked with excessively long steps, climbing very slowly to save themselves from fatigue. A novel accident befell the climbers at this altitude: a bottle of champagne carried by one of the porters burst because of the diminished pressure of the atmosphere. A terrific wind now rose which brought the climbers to a halt, and a fire was kindled behind a great boulder. A hasty reading indicated that an altitude of more than twenty-one thousand feet had been attained.

With the summit now but two thousand feet above them, the leader of the expedition succumbed to mountain sickness. When the time came for the last attack he struggled to his feet but, after taking a few steps, fell fainting to the ground. The rest of the party was obliged to leave him and continue alone. A few minutes later he partially regained his strength and made a last desperate attempt to

overtake his companions. The effort was beyond his strength, and he once more fainted. Several hours later, the party, after having attained the summit, returned. The altitude had been found to be 23,080 feet. In the annals of mountain climbing there is probably no similar case in which the leader of an expedition, after a long journey, has failed so near the goal that his companions attained.

Aconcagua continued for many years to appeal strongly to mountain climbers. It seemed to be considered essential in making the grand tour of the great mountains of the world. Sir Martin Conway, who has so many conquests to his credit in the Alps, in the Himalayas, in Norway, and elsewhere, attacked Aconcagua in 1898. He brought two veteran Swiss guides to South America for the purpose, and proceeded to organize his expedition on an elaborate scale. After a careful survey of the region and a study of the routes formerly taken, it was decided to approach Aconcagua by way of the Horcones valley, which runs at right angles to the main pass of the Andes.

A base-camp was established at the Baths of Inca, and the Swiss guides were sent ahead

to explore. Swiss guides are much more at home in the high altitudes of the mountains of foreign countries than the natives who have spent their lives in the region; this has been proved by many experienced in the Himalayas, the Canadian Rockies, New Zealand, and South America. The ice problems of rock and snow climbing are international in character. After a preliminary survey the guides returned and reported favorable conditions for the attack on Aconcagua.

From the first, great discomfort was experienced from the sun. Few climbers seem to have suffered so much in this respect. On the eve of their departure they enjoyed a remarkable sunset, which the records of the expedition praised enthusiastically. Sir Martin wrote, "The red of sunset beautified every mountain," and added that "the color can be suggested by no pigment in the world, but is like the live core of a volcano." The reference to the volcano seems to have been prophetic. The party subsequently suffered severely from the glare of the scorching sun, which even when they were traversing the snow-slopes gave them all severe headaches. They were

obliged to set up their tents for shelter from the "terrible" sun; they rested until the sun had set, when it grew rapidly cooler.

An early start was made the following morning. Provisions were carried for but three days, since it was confidently expected that the summit could be reached in less than half that time. Long slopes covered with loose stones that were now encountered offered unexpected resistance. The veteran climber, who had attacked many difficult mountains in other parts of the world, stated afterward that never in all his experience had he encountered more tiresome climbing than on these slopes. At every step the climbers slipped back, so that it was necessary to climb fifteen hundred feet to make an advance of one thousand feet. The loose stones continued up the base of the summit.

At this altitude a ridge was discovered where the stones seemed to have been arranged by human hands. Near-by an old rag was discovered in a chink of the rocks, which left no doubt that the place had been previously visited. A further search disclosed unmistakable evidence that Fitzgerald's camp had been pitched at this point. The party suffered se-

verely at this altitude from the cold and especially from the difficulty of keeping their feet warm. No ordinary coverings sufficed; the men wore three or four pairs of socks and mountain boots especially made for the purpose, and they still suffered.

The start for the final dash for the summit was made at 3 A. M. in order to take advantage of the hardened snow before the morning sun could soften it. This necessitated several hours' climb by lantern. When daylight broke the climbers found themselves in sight of the foot of the gullies that lead directly to the top. So clear was the atmosphere that it appeared the summit might be reached in another hour; but the leader of the party, to forestall disappointment, told his companions that three hours' climbing lay ahead of them. At the end of this time the summit looked no nearer than at first.

The climbers were now suffering severely from the rarefied air. Every time one of them slipped back—a frequent occurrence—he was obliged to lie down, panting, until he could regain his breath. The rock-slope was occasionally broken by a patch of snow, which af-

forded a brief respite. As they rose higher all complained of violent pains in the head which threatened to incapacitate them. A little further, two of the party were obliged to give up and returned to the base-camp. It had now become a question of endurance.

When the gully leading to the top was finally reached, the snow was found to be so soft that the feet sank in it as in sand; the cold was extremely severe. From this point the final ridge of the mountain was clearly visible, and the sight lent new life and courage to the climbers. The packs were lightened for the final effort, and everything but one small camera was left at this point. A stiff climb now brought the party up to a smooth bed of snow.

From this point a long fine edge reached out for more than a mile to the final summit. The rise in this distance was but sixty feet, but the ridge offered precarious footing. On one side the ground fell sharply away for three hundred feet; on the other a mile-long slope extended like a toboggan slide straight for the glacier below. The party was roped and started out cautiously across the knife-like edge. They were now on the crest of the

Andes at an elevation of twenty-three thousand feet balancing themselves against a high wind. At last a firm rock was reached, and the climbers scrambled to the top of it and found themselves on the highest point of the Andes.

The difficulties of climbing in the Andes probably are second only to those met in the Himalayas. The crossing of the mountains by the more familiar passes invites curious adventures. To-day the transandine railroads, by means of tunnels, make the journey far below the avalanche-swept peaks. In 1860 an expedition under the direction of Major Rickard, an Irish mining engineer connected with the Argentine Government, started out from Valparaiso to cross the continent by way of the Cumbre Pass, his luggage including elaborate scientific equipment, which was carried on mules. The major took with him his dog, which with rare foresight was provided with leather shoes to assist in climbing the snow-slopes.

The start was made at 2 A. M. one morning to take advantage of the firm snow. The path leading to the pass was but a foot in width, and it alternately wound along the steep face of a

cliff and again over the knife-like edge of a ridge. A heavy snow-storm with high wind, common in this region, shut out all objects a few feet away. It was early in April, which is the beginning of the Andean winter, and the storm soon developed into a blizzard. At an altitude of twelve thousand feet a unique danger was encountered when a flock of condors attacked the party. When they had been frightened away by the guns, the wing of a bird that had fallen was found to measure nine feet from tip to tip.

On an especially exposed part of the trail the wind blew one of the mules from the trail, laden with scientific instruments, over the side into the abyss. The leader of the party lost his hat and his compass in the same way. It was impossible to advance or retreat, and to escape the hurricane the party buried themselves deep in the snow and remained in this precarious shelter for many hours. When the storm had abated the party pushed on and crossed the pass, when a rude Alpine, or rather Andean, hut was found which afforded shelter.

The conquest of Mount Cook of the Southern Alps of New Zealand proved to be one of

the most baffling climbs in the history of mountaineering. Five expeditions made the long journey out to New Zealand, and each failed to reach the summit after approaching within about one hundred feet of its summit. The mountain was finally conquered in 1894.

The beauties of the New Zealand mountains are little known in Europe or America. The opportunities offered for climbing these peaks have attracted many mountaineers from England. The importance of the ranges was not appreciated until 1862, when Dr. Julius von Hoost first penetrated the Losman Glacier and reached the eastern base of Mount Cook. His account of the region attracted wide attention to these little known mountains.

A generous offer was made by the Alpine Club of England in 1873 to assist any one who would attempt the ascent of Mount Cook. It was not until ten years later that the offer was accepted. The attempt was then made by the Rev. Spotswood Green of Dublin, who became the pioneer of Mount Cook. He brought with him two Swiss guides and attacked the mountain with a well organized expedition. Two attempts were made, neither of which brought

him near the summit. On the third trial he climbed as he believed to within fifty feet of the topmost peak, when he was forced to descend. He had been delayed by bad weather, and but one hour of daylight remained for the last dash. While descending the mountain he was without shelter for sixty-two hours. Later surveys indicated that he reached a point about two hundred feet from the top.

Between 1886 and 1890 four attempts were made to climb Mount Cook, following Green's route, and in each case the party came within about one hundred feet of the summit. In 1891 the Alpine Club of New Zealand was formed, and considerable mountain climbing activity followed; but Mount Cook still resisted all attacks.

The remarkable expedition led against Mount Cook by Freda du Four, a woman climber, attracted much attention. The climb to the Bivouac, a small patch of rocks at an elevation of eight thousand feet, was made without accident. The ledge is just large enough to pitch two tents and has been used on other occasions. The route was then reconnoitered and the course for the next day

determined upon. During the night the wind rose and the snow fell, but the party nevertheless started out promptly according to schedule. A snow-basin had been crossed when a precipitous ice-wall was met that barred all further progress. The expedition was thereupon abandoned, but the leader of the expedition comforted herself with the reflection that at least no one else could go that way the same season and that another year would find her early on the trail.

The next year the same party were back at the Bivouac with undiminished enthusiasm. The guides were sent out to "kick steps" in the snow and reconnoiter; they returned to report the outlook favorable. All were awakened at 1 A. M., and, after breakfast, they started out at 2:45 in the morning. They were carefully roped, the lady walking between two guides. A stop was made at 5 A. M. for "tea"—decidedly an unconventional hour.

The rocks encountered were coated with green ice and the footholds and handholds were very precarious. It became necessary to cut steps in the slope, but the progress, though slow, was steady. After many hours of such

work it became evident that the party was approaching the summit. A ledge covered with snow was reached which was evidently the border of the uppermost peak. The ancient rule of etiquette of "ladies first" was carefully observed. The guides stood aside, and the leader of the party went ahead. She was given a considerable length of rope and assisted over the ledge. A moment later she found herself very much alone on a smooth bit of snow on the top of Mount Cook.

"I felt very lonely," she writes, "and wished to cry. A moment later the guides appeared. They caught my hands and shook them, their eyes glowing with pleasure and pride, and with an effort I swallowed the lump in my throat and laughed instead."

The ancient legend that the waters of the Nile had their origin in a mysterious mountain in Africa was brought to Europe about twenty-five centuries ago. It appealed strongly to popular imagination and was often repeated. Ptolemy had called this mythical range the Mountains of the Moon; Aristotle speaks of the "Mountains of Silver" which formed the source of the Nile. They also inspired a beau-

tiful line in Æschylus, who wrote of "Egypt nurtured by the snows."

The classical myth persisted throughout the Middle Ages. There seems to have been absolutely no confirmation for the legend for centuries. The ancient geographers must have profited by private sources of information that still remain a mystery. When Henry M. Stanley crossed central Africa he heard a legend of a mountain covered with salt: the natives, of course, had no knowledge of snow and accounted for the snow-capped mountain range in this way. Stanley actually saw the mountain at a great distance on a later expedition, and was able to bring back confirmation of its existence in 1888.

The native name for the great range of snow-peaked mountains is Ruwenzori. The altitude of its highest peak was estimated at more than sixteen thousand feet. It quickly attracted world-wide attention, and many mountain climbers aspired to be the first to conquer it. Between 1888 and 1906, when it was finally scaled, no less than twenty-one expeditions were led against it without success. This activity, at the rate of almost four ex-

peditions each year to so remote and inaccessible a peak, is remarkable. The climb was found to be an exceedingly difficult one, requiring long marches. The snow work on mountains in the tropics, indeed, is especially dangerous, since by day the sun in such latitudes rapidly melts newly fallen snow, while the freezing cold of the night transforms snow into ice slopes.

The Duke of the Abruzzi conducted the twenty-second attempt on Ruwenzori in 1906. His best efforts were required for the work. The last hours of the attack were especially dramatic. After their long trip to South Africa and the tedious approach to the mountain, the party finally reached the glacier which leads to the main peak and camped at 14,817 feet. The goal was now at hand. Climbing upward from the tropic heat of the plains, the party had suddenly reached extremely low temperatures and high winds. The duke spent an anxious night crowded with his guides into a single tent.

The day dawned inauspiciously dark and threatening. Carefully roped together, the party started up the last face of the glacier.

The snow had the pale, luck-luster hue that indicates the approach of bad weather. They found the actual peak protected by a formidable rock precipice and a great snow cornice. Two courses were possible: one was to climb the precipitous ice-wall overhung by the cornice; the second was to retreat and attempt a less direct line of approach. It was decided to take the shorter though much more dangerous course. To add to their discomforts, a dazzling white mist crept up the slope and shut out all objects a few feet away.

The party started upward, their faces to the steep wall. It was found impossible to turn to the right or left. One climber stood almost vertically above another, so that snow or rock loosened in the scramble would be rained down on those directly below. As they climbed higher, an impenetrable mist rose with them, so that they could see nothing below. The bottom of the cornice was finally reached. Here they discovered a cleft in the rock, a narrow, vertical gully about six feet in height. Climbing on one another's shoulders, they contrived to cross the cornice. The duke was the first to set foot on the highest peak of Ruwen-

zori. A great sea of fog lay below them, through which appeared two peaks, the extreme summits of the group. The elevation was found to be 16,757 feet. The mysterious mountain that had obsessed the minds of men for twenty-five centuries was at last conquered.

No mountain is too remote or inaccessible to discourage the modern mountaineer. The four corners of the earth have been ransacked to discover new problems in climbing. Few people have even heard of the Altai Mountains of northern Siberia or of their great peak, Belukha. It rises from a remote plateau near the Chinese boundary-line 640 miles from the nearest railroad. The mails are carried irregularly a part of this distance. The journey northward from the railroad over the snows by sled has much in common with a north-pole expedition.

A Russian explorer attempted Belukha in 1900 reported that he ascended to an elevation of 13,300 feet; he estimated the mountain's height at fourteen thousand feet. Although this altitude is not remarkable when compared with that of many mountains of other countries, Belukha nevertheless has a great attrac-

tion for mountain climbers: it is a virgin peak and probably the highest in Siberia, while the astonishing difficulties of its approach in these remote regions invite the adventurous mountaineer.

Among the innumerable narratives of mountain conquests, the story of the attack on Belukha is in many respects unique. A well known English mountaineer, Samuel Turner, attempted to climb Belukha in the winter of 1903. The choice of the winter season for such an attempt, especially in so northern a region, is most unusual; for the difficulties of these regions are serious enough in midsummer. Turner chanced to be in northern Russia at this season on a business trip, and the mountain climbing expedition was a second thought.

After a careful study of the situation he found that the extreme cold of the winter, if it could be faced, would actually work to his advantage. It was necessary for him to cross vast regions to reach the base of the mountain. If the ground was solidly frozen, progress by sled would be greatly simplified. In this region winter often changes to summer with

great suddenness. Within a period of two weeks the ice-fields may be turned into a great morass, which it is virtually impossible to traverse. On consulting local officials before starting, Mr. Turner was warned that he might be marooned by a sudden thaw and find himself completely cut off from civilization in the wilderness. Every one he consulted believed the ascent to be impossible.

Mr. Turner left the Transsiberian Railway at the Oli station, the nearest point of departure for an attack on Belukha. The Altai Mountains lay 646 miles to the southward. It was hoped that the snow-sleds drawn by horses, which were used for the journey, could be counted upon to do twelve or fourteen miles an hour over the snow. Later it was found that an average of five or six miles was all that could be hoped for. The journey carried Mr. Turner through remote settlements whose inhabitants had never before seen an Englishman. The country was for the most part extremely wild, with long stretches of wilderness between the scattered native villages. The snow-fields were roamed by wolves, bears, and other wild animals. The greatest danger,

however, was from the attack of escaped Siberian exiles who might be encountered. The temperature throughout this journey was often thirty degrees below zero, enough to cool the enthusiasm of any but the most devoted mountain climber.

A journey of two days and three nights was made by one snow-sled, the rest of the distance being covered for the most part afoot. To reconnoiter the ground, two neighboring mountains were ascended. It was found that Belukha consisted of two peaks, with a saddle running between them. At this most inopportune time the guides refused to go further, and Mr. Turner was obliged to proceed alone. He succeeded in reaching the summit of the second ridge, where he found the altitude to be 13,800 feet. Here he left his name and an account of his journey, written both in English and Russian, under a large stone, and attempted a higher peak. The extreme cold and the difficulties of the ice climb, however, proved too much for him.

The latitude of the mountains presented several problems in climbing beyond the experience even of an Alpinist. Mr. Turner

found it necessary to practice climbing on skis, so deep and loose was the snow. At one point he dug down for more than six feet without coming to earth. One must admire the courage displayed in tackling such dangerous problems in climbing while alone and so hopelessly remote and far from assistance in case of accident. Some of the rock climbing in these ascents was especially hazardous. In one place Mr. Turner was obliged to climb down a rock face for thirty feet and then, falling forward, grasp the rock across a chimney four feet wide. The rock proved to be very soft, meanwhile, and often broke under his fingers. He had the satisfaction of naming three of the great peaks thus explored, calling them Faith, Hope, and Charity. They have never been climbed.

In climbing Belukha Mr. Turner had a narrow escape in a ride atop an avalanche. First-hand experiences of such an adventure are naturally rare. "The snow began to move," he writes, "and I with it. I tried to stop myself with my ice-ax for a yard or two, when I lost all thought of everything except that I was being carried to destruction. I turned my

head downward and stopped, the snow closing over me, but I was able to kick the snow from my head and found I could breathe all right. I had luckily retained hold of my ice-ax, and this stopped me from gliding toward the precipice." The climb was given up, and Mr. Turner descended, picked up his guides, and, after a long journey over the snows, finally reached the outposts of civilization. The field is still open.

CHAPTER XIII

FOLLOWING NOAH'S TRAIL

NO mountain in the world, perhaps, is more familiar by name than Mount Ararat. Like many of the biblical mountains, its name is a household word. It comes to most of us as a surprise, however, to learn that Ararat has long been a famous peak in the history of mountain climbing. It is not only higher than Mont Blanc, the highest point in Europe, but presents several interesting problems in climbing and has been the setting for dramatic adventures.

According to the Scriptures Noah's ark rested "on the mountain of Ararat." The mental picture so deeply engraved on our minds of the conventional ark resting on the topmost peak of the mountain is doubtless due to the imagination of early illustrators. The height of its ultimate peak, 17,260 feet, could obviously not have been a measurement of the

depth of the waters of the flood. Mount Ararat stands in a mountainous district of Armenia in Asia Minor and was long considered in this region to be the highest mountain in the world. It receives its name from a king named Arai, who reigned here about 1700 B. C. Originally called Arai-Arat, literally, "the fall of Arai," the name has been shortened to Ararat. Until comparatively recent times it was considered absolutely unclimbable.

The legend persists that fragments of the ark still lies upon the top of the utmost peak of Ararat. According to the ancient belief, Noah, after descending the mountain, built a vineyard on its side below the snow-line and was buried there. In any event a romantic interest attaches to the famous mountain, which has served to attract many mountain climbers to attempt its ascent.

The first serious effort of which we have any record was made by Professor Parrot in 1829. An old monastery high up on its sides offered shelter on the first night. In an attack on the eastern face of the mountain, Parrot had reached an elevation of twelve thousand feet

when he found further progress impossible because of the steep ice-slopes. He next attempted the northwest side. The first day brought him to the snow-line, where he spent the night before a fire. The party was early afoot next morning, and all were hopeful of reaching the summit by noon. The upper slopes again proved impossible, and the highest altitude reached was but 14,440 feet. With less than three thousand feet to go, the party once more turned back.

A third attempt was now made with increased forces and new equipment. The party included several Russian soldiers in addition to the guides. The steep snow-slopes of the ultimate peak had been reached when, profiting by past experience, a path was made by laboriously cutting steps in the ice with hatchets. It was necessary to skirt a precipice of great depth with very precarious footing, but the party, favored by good weather, finally attained the highest peak. The descent was found even more difficult than the climb. The observations made on the summit led to the belief that the mountain is volcanic in or-

igin and that it is probably one of the oldest mountains in all Asia. No relics of Noah's ark were discovered.

The ascent of Ararat made by M. Khodyke in 1850 had several unique features. For the first time adequate scientific instruments for making observations were carried to the summit. It is assumed that Noah's ark, if it once visited the summit, was supplied with primitive equipment. The instruments and supplies carried by Khodyke were so bulky that they were first loaded upon horses. The snow soon proved too deep for the animals, and they were sent back and the luggage placed on snow-sledges, which were drawn by soldiers in harness. The luggage included a large cross that was to be erected on the summit.

The terrace of the summit was reached by nightfall. The position was extremely exposed, and no shelter could be found. A small space was cleared in the snow, where the party huddled together and waited for daylight. The morning brought a severe thunder-storm, and the peak was hidden by clouds. A start was made by six o'clock, however, despite whirling clouds, hail, and frozen snow. The

rocky crest was reached, which gradually rose toward the summit. The sleds were now emptied and the baggage carried by the guides. The ascent became increasingly difficult and dangerous. On reaching the extremity of the chain of rocks great beds of snow, ice, and stony débris were discovered, which formed the last escarpment of the summit.

On this remote ledge of the great mountain the party discovered a cross still standing, which had been placed there by Russian soldiers in 1845. The storm meanwhile increased; but the party continued to push on, taking the cross with them, until, half frozen by the extreme cold and blinded by the snow, they were brought to a stop. Half the men were now sent back to the tent far down the mountain-side, while six, who remained, camped for the night on a small plateau. To add to their discomforts, the wind rose still higher, and a severe thunder-storm with very sharp lightning continued for hours. The snow all but buried the party, so that the position became impossible, but, rallying their strength, they once more pushed on for the summit.

The third chain of rocks was now crossed in safety, when the party emerged on the tableland but nine hundred paces from the topmost peak Here they were forced to halt, however, by extreme fatigue and cold. Two tents were pitched in the snow, and the party waited for the weather to improve. They remained in this precarious position for three days and two nights, when the weather cleared, and they were once more afoot. A short climb now brought them to the top.

On the topmost summit they discovered to their amazement a cairn built of stone, which had been erected by Russian soldiers only a month before. Despite the perils of the climb, Khodyke had carried the cross to the very top. The party first knelt before it and then proceeded to erect it, planting it firmly among the stones of the summit. The scientific instruments were then set up, and much valuable information was obtained. Observations were made of four high peaks clearly visible from this elevation. M. Khodyke closes his account of the ascent with the observation that Mount Ararat has proved so difficult to ascend that he was convinced that the story that the ark

had once rested on the ultimate peak seemed improbable, since the descent of the steep snow-slopes "would have proved fatal to many of the animals."

About twenty years later James Bryce, the historian and diplomat, who later became Lord Bryce, climbed to the upper peak of Ararat alone with surprising ease. His experience admirably illustrates the influence of mere luck or of chance conditions in high climbing. Several of the upper slopes of the mountain, which threatened the earlier climbers, as we have seen, offered little resistance in this ascent. It is difficult to conceive a more striking contrast than between Mr. Bryce's more or less leisurely stroll up Ararat and the desperate struggle of the earlier climbers. Bryce was accompanied on the lower slopes of the mountain by a considerable party, consisting of six Russian soldiers, all armed, two guides, and an interpreter.

The lower slopes of the mountain were found to be very gentle. The heat meanwhile was oppressive, and the head of the party actually carried an umbrella as a sunshade. The picture of a mountain climber bound for a

seventeen-thousand-foot peak carrying a sun-umbrella is unique. Camp was pitched at an altitude of 8818 feet. It was decided that success depended largely upon making an early start next morning, and the party was awakened at midnight and was afoot by 1 A. M.

The slopes were now found rather steep but offered no serious difficulties; although the party stopped to rest at frequent intervals, excellent progress was made. Difficulties now arose, however, among the guides and helpers. They belonged to different races and could not talk with one another. After reaching an altitude of thirteen thousand feet they managed to agree among themselves, however, that they would climb no higher. Bryce thereupon set out for the summit alone. He exchanged his sun-umbrella for an ice-ax, but made no other preparations for facing the possible cold and storms of the upper slopes. He wore a conventional suit of tweed and carried no overcoat or blanket.

The summit was obscured by mists, and the course was laid by compass. The rarefied air oppressed the climber at this point, so that he was obliged to stop every few steps for breath.

The temperature high above the snow-line fell rapidly, and the climber had no protection except by tightening his loose coat. He had made excellent progress when he was effectively stopped on coming to the brink of a high precipice and was obliged to retrace his steps. Still steering by compass, he now assailed a treacherous-looking ice-slope, but climbed it without accident. The hardest part of the climb was now encountered in crossing a rocky slope rising at an angle of forty-three degrees. The rock was loose, so that the stones constantly turned under his feet, but he scrambled upward, making excellent time.

At this altitude the cold became intense, and the tweed suit offered little protection. By great good luck Bryce now chanced upon the natural steam-heating system of the mountain, for he was able to warm himself by the clouds of steam escaping from vents in the rocks. The summit still seemed far ahead, and the climber, realizing the danger of being lost in this lonely region, decided that he would climb for but one more hour, and then, no matter what his position, turn about.

For some time he continued to cross rocky

slopes when the stone suddenly came to an end, and he stepped on a hard floor of level snow. The mists still shut out the view on all sides. Bryce at once started to walk across the snow, meanwhile dragging his ice-ax behind him, that he might leave a trail that he could follow in returning. He had walked but a few feet when he noticed that the snow floor was beginning to dip downward. Luckily at this moment the mists somewhat cleared, and he discovered that he was actually standing on the ultimate summit of Mount Ararat with an uninterrupted view in all directions. He writes that he looked about him and recalled the familiar picture of his childhood, of Noah's ark resting on a gentle grass-covered slope, while the animals alighted two by two.

A remarkable ascent was made of Mount Ararat shortly after this by an American youth, Thomas Gaskell Allen, who was the first to carry the stars and stripes to the summit. It may be recalled that Mr. Allen, about twenty-five years ago, made the first tour of the world on a bicycle, in the course of which he crossed Asia. He was the first to make the journey since the famous expedition of Marco

Polo, three centuries before. The bicycle was then a novelty, and this "devil-wagon," as it was called by the natives, attracted great attention. A number of his adventures were retold in "The Century Magazine" at the time. It is interesting to recall to-day that when young Allen reached Peking he chanced to meet a young attaché named Curzon in the British consulate. The two became friends, and when years after Allen became a fellow of the Royal Geographical Society, he was sponsored by his friend, Earl Curzon, chancellor of the University of Oxford.

On finding himself within sight of Mount Ararat, Allen turned aside from his trip to make the ascent. On every hand he met with discouragement. He was assured by the natives that the mountain was wholly inaccessible. The bicycle was abandoned for the time in favor of a pair of donkeys, which were better suited to travel in the deep snows. The country at the base of Ararat was so arid that it was difficult to find enough wood to make an alpenstock. The base of the mountain was covered with burning sand. It was hard to realize that a few hours' climb would bring one

into the eternal snows. According to the old Armenian legend, the Garden of Eden lay on the slopes of Mount Ararat. If this be true the climate has decidedly changed for the worse.

The approach to Ararat proved to be very gradual, over a waste of sand and ashes. The only inhabitants of the region at the time were lawless Kurdish tribes. The old inhabitants proved to be friendly but surprisingly ignorant of the country. They insisted that the mountain was unclimbable and, when told that it had been climbed probably half a dozen times, shook their heads incredulously. They were extremely suspicious of the camera carried by the climbing party. The first stage of the ascent was a nineteen-mile march, during which the party ascended from three thousand to seven thousand feet, when camp was pitched. Here several of the guides deserted, and the party had to push on with diminished forces.

The first snow was found at an elevation of eight thousand feet. It soon proved too deep for the donkeys, who floundered helplessly, buried to their bellies, and had to be abandoned. The troubles with the mules naturally aroused

a question of Noah's behavior under similar conditions with the animals from the ark. At an elevation of nine thousand feet the supplies were packed on the backs of the climbers, who now floundered with their heavy loads through the drifts. It had been hoped that the summit could be reached the same day, and that the return could be made to camp by night. A stiff climb of two and a half hours brought the party to the ridge about one thousand feet below the base of the main dome. An elevation of eleven thousand feet was reached, when it was decided to camp for the night.

The slope was everywhere so steep that no place could be found for sleeping. A carpet was spread on the snow, and on it the climbers rested. It was impossible to start a fire. Allen observed that at home iced tea had usually been considered a luxury, but that on the slopes of Ararat he for once failed to appreciate it. A start was made for the summit at 3 A. M. By seven o'clock an altitude of 13,500 feet had been reached without special effort. The slope now grew much steeper, and a dangerous chasm menaced the climbers on one side. While struggling up this slope a cloud of

steam like the exhaust from an engine suddenly spurted in their faces, almost smothering them.

It was found necessary to cut steps in the steep ice-slopes. So stiff was the climbing at this point that it was necessary for the climbers to hook their ice-axes firmly above them, and then haul themselves up by main strength. After hours spent in thus pushing and pulling one another, they at last sank almost exhausted on the summit of Mount Ararat. The top was carefully explored, but there was no trace of the crosses planted there in former years. A silk American flag that had been carried to the top was attached to an alpenstock and waved amid this solitude. It chanced that the day was the Fourth of July, and four shots were fired from Allen's pistol by way of celebration.

CHAPTER XIV

MOUNTAIN TRAGEDIES

SOME years ago an American visited Chamonix with the avowed intention of scaling Mont Blanc, and engaged guides and purchased mountain climbing equipment on a lavish scale. His forces were at last assembled and started under hopeful conditions. After leaving the hotel the procession chanced to pass the church in whose graveyard lie many of the heroes of tragic mountain adventures. The American glanced carelessly at some of the laudatory inscriptions on the tombstones, which had been purchased at so high a price, and stayed to read further. Before exhausting the list of tragedies he disbanded his party and returned to his hotel. Thereafter he occupied a comfortable chair on the piazza, commanding an excellent view of the mountains, which he explained was "plenty good enough for him."

Despite the accidents and tragedies in the history of mountain climbing, the sport is not necessarily dangerous. When accidents befall, they are almost invariably due to ignorance and lack of experience or to downright carelessness. Most accidents are avoidable, given proper caution and experience in the craft. Every accident encountered in mountaineering tends to safeguard future climbers. The more dangerous trails are thus eliminated, and new lessons are learned of perils encountered in snow, ice, and rock climbing which may in future be avoided. There is, of course, an element of chance that cannot always be anticipated.

Crevasses often lurk insidiously beneath coverings of innocent snow, where a single mistake may prove fatal. Their peculiar terror lies in the fact that these hidden depths may entomb a man alive far from any possible assistance. In 1864, a comparatively early date in mountain climbing, a guide, passing over an apparently firm ice-bridge in the Alps, suddenly fell through. He had neglected to be roped and sank instantly from sight beneath the snow. Heroic efforts were made to reach him.

A companion was lowered by ropes for a distance of eighty feet, where he found himself swinging in space above a dark abyss. His shouts brought no reply. A bottle was then lowered to a depth of two hundred feet without reaching the bottom of the crevasse. On being drawn up it was found to be incased in ice. The body was never recovered. Doubtless death had come within a few seconds after the fall; but the possibility that one might reach the floor of a crevasse badly injured and wholly helpless but still alive, while far from any possible assistance, lends a peculiar terror.

Several mountaineers have fallen into crevasses and have lived to tell the tale. Perhaps the most remarkable adventure of its kind befell a climber named Sachs, who left Zermatt with two guides in 1897. In crossing the Trift Glacier he fell into a crevasse hidden by the snow and sank to his armpits. He was roped to his companions in the approved manner, but the rope slipped, and Sachs suddenly disappeared from view. He had fallen through an opening less than five feet in width but widening at the bottom.

While one of the party rushed away for

assistance the other leaned over the opening and continued to shout Sachs's name. There was no reply at first, but at last a faint voice from far below was heard. "I am alive," came faintly from below, "I have broken my arm." When assistance arrived, a man was let down into the black crevasse. Three ropes were used whose combined length was two hundred feet—certainly a perilous enterprise. The ropes meanwhile cut deep into the snow on the sides of the crevasse, which threatened to give way at any moment under the strain. While dangling unpleasantly above a deep abyss, the guide was surprised to hear a voice near him remark casually, "Good evening; how do you like it down here?" Sachs was then discovered sitting on a bank of snow. He explained later that after falling he was probably unconscious a long time; he heard the voice calling from above, but could not make himself heard. He had counted the hours as they passed with little hope of escape.

The first of the women victims among Alpine climbers was the wife of an American named Marks, who was lost in 1870. Mrs. Marks and her sister, Miss Wilkinson, with

CRAIG AND SADDLE MOUNTAINS, CANADIAN ROCKIES

LAKE LOUISE, CANADIAN ROCKIES

ON THE PROFILE OF MT. ASSINIBOINE

ROUTE TO THE SUMMIT OF MT. ASSINIBOINE

their guides, had passed the Grands-Mulets, when the ladies of the party were put in charge of the guides and Wilkinson and others pressed on. He had gone but a few feet when a scream was heard, and on rushing back it was found that his sister and a guide had fallen into a crevasse. The bodies were never recovered.

One of the most distressing tragedies in the annals of all mountain adventure was the loss of a considerable party on the summit of Mont Blanc. The party consisted of a Scotch minister named McCorkindale and two Americans, Randall and Bean, accompanied by three guides and five porters. All succeeded in reaching the summit in safety, when they were marooned by a storm for eight days. Their absence was observed in the valley, but the storm was so severe that it was considered hopeless to send assistance. On the ninth day a party went up and, on reaching the summit, discovered ten bodies frozen to death in the snow. No trace was found of the eleventh member of the party. Mr. Bean had written a pathetic note to his wife after all hope had been abandoned. "We are without food," he wrote. "My feet are already frozen, and I am dying. I have only

strength to write a few words. I die with faith in God, and my last thought is of you."

That fact, may be stranger than fiction has a remarkable illustration in the experience of a fatal attempt to climb Mont Blanc in 1820. The expedition was led by Dr. Hamel, who had been employed to make scientific observations. The party was accompanied by twelve guides and started out with elaborate equipment. It was singularly unlucky from the first. While in a remote part of the mountains one of the guides chanced to take sulphuric acid in mistake for vinegar. It would be difficult to conceive of a more awkward place for such an accident. The guide was saved, however, by administering wood-ashes mixed with water. The party reached the Grands-Mulets in safety and pitched their tent, when a violent thunderstorm descended, which lasted most of the night. In the morning one of the party declared that he had "had enough of being perched on a crag like an eagle" and with two of the guides returned to the valley. The others pushed on and were within sight of the end of their journey, the summit of Mont Blanc, when in crossing a snow-slope they

were overtaken by an avalanche. One of the party who survived has left a remarkable first-hand description of a glissade on the crest of an avalanche which is unique in mountain literature.

"The snow above us," he wrote, "rushed down, burying us all at once in its mass, hurrying us toward a crevasse a quarter of a mile away. The accumulation of snow threw me on my back, and I was carried down in spite of all my struggles. In a couple of minutes I emerged and saw three of my companions sitting on the snow some distance below me quite motionless and silent, up to their waists in snow. I was about to make a jesting remark when a second glance showed me that the other members of the party were nowhere to be seen." Three of the party were lost. No trace of the bodies was found until 1861, when guides discovered in the mountains the remains of a human body, which was brought to Chamonix. The cloth and the cap, preserved so long beneath the snow, were still as good as new. A leg of mutton, which had been part of the provisions, was still solidly frozen after being buried for forty-one years.

There is a well authenticated case in the Swiss Alps in which two women were literally buried alive beneath the snow for five weeks and yet survived the experience. They lived in a chalet high up on the mountain-side when an avalanche, straying from the usual path, overwhelmed them. The head of the family was away from home at the time and escaped. On hurrying to his home he found it buried beyond all hope of recovery. It was thought that no one could have continued to live beneath the avalanche and hope was abandoned.

When more than a month had passed and the spring suns had melted a considerable part of the snow, it was decided to try tunneling through the banks that remained. After a week of vigorous digging the explorers came upon the farm-house, which to their surprise had withstood the avalanche and stood virtually undisturbed. They entered the building and searched room after room, but found no bodies. After searching every corner of the house, a tunnel was dug through the snow to the barn, which stood at some distance. Here, again, the building was found intact, and the two women were found weak from exposure

and starvation but still alive and conscious. They had chanced to be in the barn when the avalanche fell and had managed to sustain life by eating some chestnuts stored there.

One of the pathetic tragedies of the mountains is that of a young Englishman who suddenly fell into one of the hidden fissures in the ice. He was visiting the Alps with his bride when a misstep plunged him into a crevasse. All efforts to reach him failed, and his wife and party abandoned hope. His wife, however, had scientific observations made to find if the glacier might not at some time in its slow movement bring the body to a point where it might be recovered. It was believed that the body might in this way be found, but only after a period of forty years.

The widow returned to the foot of the glacier when the time had elapsed, and, according to the story, the body was finally found. It had remained unchanged in the intense cold of the glacier throughout this period. The wife had returned an old woman, while her husband's body when recovered was that of a young man, wearing the clothes of another generation.

The Matterhorn still continues to be a very

formidable antagonist. One of the most distressing of the accidents on its slopes occurred in 1907, when three young climbers started from Zermatt to ascend from the Italian side. The route has been definitely mapped and is usually taken in easy stages, with rests at the huts conveniently placed along the way. The start is commonly made early in the morning, and the night is spent at the hut below the Great Tower.

The party lost valuable time in the early hours of the climb, were unable to reach the hut, and were obliged to spend the night out of doors below it. They passed the hut the next day, and had reached the base of the actual peak when a severe storm broke upon them. Instead of descending to the hut they spent the second night on the mountain. The exposure proved too much for one of the party, whose name was Soprri, and he died before morning. The body was placed in the shelter of some rocks.

Instead of returning by way of the hut, the two remaining members of the party tried to descend by another route. A third night was spent in the open, and then they tried to de-

scend. Both men suffered severely from exposure and finally dropped to the ground from exhaustion. One at length managed to stagger on and chanced upon a party of guides, who returned, rescued the frozen man, and brought him safely down the mountain. The party had, in all, spent four days and three nights on the mountain in one of the severest storms of the season. The body of the third climber was recovered with great difficulty.

Despite the Alpine huts and the vigilance of the relief parties, there are many regions in the Alps where the most experienced climbers may come to grief. In an ascent of Mont Blanc in 1902 a party of four had reached the Grand Plateau when they were overtaken by a blinding storm. It was soon realized that an advance would be foolhardy, and the climbers turned to retrace their steps. Two of the party were experienced Swiss guides who had spent the greater part of their lives on the mountains, but even their skill did not suffice, and the party was soon hopelessly lost in the snow. As a last desperate resource it was decided to dig holes in the snow for shelter and to wait for morning. The storm increased in fury, with

extremely low temperatures, and two of the men died of exposure during the night. Yet they were within twenty minutes' walk of shelter and safety.

The weather cleared next morning, and those who were left alive hurried down the mountain. In their haste one of them fell into a deep crevasse; it was afterward found that he had fallen a distance of 130 feet. By miraculous luck he reached the bottom uninjured, but found himself surrounded by perpendicular walls of smooth ice that it was impossible to climb. He was able to make himself heard to his companion above and urged him to rush down the mountain for assistance.

A single member of the party was now left alive on the face of the mountain. A moment later, while leaning over the crevasse, he slipped, fell head first, and was killed by the fall. The man imprisoned alive at the foot of the crevasse knew nothing of this last death and waited patiently for assistance. It would be difficult to conceive of a more hopeless situation: three of the party were dead, and the fourth man was imprisoned at the bottom of a deep crevasse high up on Mont Blanc.

But the upper slopes of the mountain are continually swept by powerful telescopes from the valley. It chanced that the accident was observed by the watchers at Chamonix, ten thousand feet below. A figure had been seen at the edge of a crevasse which a moment later disappeared, and the watchers were quick to draw conclusions. A relief-party was quickly organized and started up the mountain, making the best possible speed. It was a seven-hour climb from Chamonix to the crevasse under the most favorable conditions.

Meanwhile several guides, who chanced to be on the upper slopes of Mont Blanc above the Grand Plateau, saw the relief-party approaching from below. It was seen that the party was climbing at top speed, which indicated that it was not made up of ordinary climbers but was bound on relief work of urgent nature. The guides high up on the mountain at once hurried down the mountain as fast as possible to join forces with the ascending party, the two meeting a few hours later.

Neither force, however, had any definite information to work on. It was found to be impossible to locate the crevasse where the man

had last been seen. They searched crevasse after crevasse, leaning over the sides at great peril and shouting, but they received no reply. They had almost decided to give up the search when they heard a faint call from one of the crevasses. A rope was thereupon let down for a distance of about 150 feet. The mysterious voice was again heard, this time explaining that the rope was still about forty feet too short. It was pulled up and lengthened and again let down. It then reached the prisoner, who tied himself to it and signaled to be hauled up. The distance of nearly two hundred feet rendered such an experiment very hazardous. The body that formed the weight of their extremely attenuated pendulum was in great danger of being violently knocked about in swinging against the ice-walls. The guide was finally hauled to the surface uninjured. It was now discovered, however, that he had left his ice-ax below. It is, considered a breach of etiquette in climbing to lose one's ice-ax under any circumstances; and the guide, at his own request, was once more lowered two hundred feet, whereupon he found his ax and finally reached the surface and safety.

The great mountain peaks often attract lightning, and in bad thunder-storms the danger of being struck is often considerable. The higher the elevation and the more exposed the position, the greater as a rule is the danger. A distressing accident of this kind once occurred at the very summit of Mont Blanc. One of the porters of a climbing party was struck by lightning and charred and blackened. His companions administered first aid as best they could in the remote spot. It was impossible to descend the mountain meanwhile until the storm passed, and several hours had to be spent there. On descending to the highest hut the party found several climbers, one of whom was a physician; and he gave the injured man medical assistance. The struggles of the descent proved too great a strain, however, and the man died on the way down.

The watchers at Chamonix, thousands of feet below, had observed the progress of the party and were able from long experience to guess the general nature of the accident. It was seen that the climbers were descending very deliberately, carrying a stretcher, which indicated that some one was badly injured.

This showed, however, that the injured man was still alive. It was observed later that the party, while still proceeding very slowly, was dragging an object behind; it is a rule of the mountains that a dead body is never carried, but is dragged in a sack.

Many volumes might be filled with the climbing adventures in the neighborhood of the famous hospice of the Great St. Bernard. Despite its altitude of 8110 feet, the old monastery is annually visited by about twenty thousand people. Its hospitality has been famous for centuries. Every visitor is cordially received and is provided, if he desires, with food and shelter without a word said of remuneration. If the visitor chooses, on leaving he may make a contribution. As a silent reminder a box is placed at the entrance to receive the present, but that is all. The hospitality is at times abused; it has even been rumored of late years that it may, on this account, become necessary to change the rule of the hospice.

The monastery is, of course, famous for its dogs, which have made its name a household word the world over. The dogs of the St.

Bernard Monks have long assisted in rescuing those lost or in distress on the mountains. Nowadays an excellent carriage-road reaches to the doors of the monastery and which minimizes the chances of visitors' being lost in the snow. The intelligence of the dogs in tracing people in the snow and bringing them assistance might be illustrated by countless stories. Mark Twain's description of their work will naturally be recalled: he says, it will be remembered, that the St. Bernard dogs, on discovering climbers in distress in the snow, supplied them with food and drink, administered first aid, and gave them a hot bath, and then, hoisting them on their backs, carried them to the monastery and nursed them until they were strong enough to put something in the contribution box.

A successful climber of high mountains should prove a successful arctic explorer, just as the conqueror of the poles should qualify for mountain work. The parallel is much closer than is generally supposed. Both must accustom themselves to exposure at low temperature and to a life for long periods in the eternal

snow. They must be capable of sustained efforts for many days on end. Both types of explorers must be skilled in snow work and in matching their wits against the treacheries of the ice and snow. The mountain climber frequently faces at high altitudes temperatures as low as those at the poles, and must battle against wind-storms of equal violence and persistence.

In many respects their problems are identical. An experienced eye is required, and it must be constantly on the alert to judge the supporting power of snow-fields. The danger of the crevasse is common to both. If the mountain journey is shorter than the polar expedition, it has the added difficulty of perilous climbs. In at least one instance, that of Dr. Cook, a mountain climber has also assayed polar adventure. The polar explorer, however, seems to appeal to the popular imagination more strongly than any climber of the mountains. At the conclusion of an arctic journey, however unsuccessful, large audiences gather throughout the world to listen to the recital of adventures. The successful conqueror of

mountain heights can command no such audience, even if he desires to do so. The recent remarkable growth of interest in mountain climbing, may work changes in the public attitude.

CHAPTER XV

IN THE HIMALAYAS

A FEW years ago it was reported from India that the Duke of the Abruzzi had reached the summit of K 2, the second highest mountain in the world, and had then assailed Mount Everest. The impression was conveyed that after descending one mountain he started directly up the other. This optimistic report admirably illustrates the ignorance of ordinarily well informed people concerning the Himalayas. The two highest mountains in the world, Everest and K 2, are upward of two thousand miles apart and are separated by the most rugged country in the world.

One school of mountain climbers gains satisfaction from the fact that the Himalayas have, in their phrase, "never been desecrated" by the railroad or by mountain huts or climbing-ropes to safeguard tourists; and this is literally true. Centuries, indeed, may pass before

the mysteries of the mountains are exhausted. Much of this Himalaya territory has never been visited by white men; there an immense no-man's-land lies far beyond the outposts of civilization which will long continue to be the mountain climber's paradise. As a result of this isolation, the Himalayas have been wholly neglected until the last few years. The time and expense involved in organizing a mountain-climbing expedition to the remote regions of India or Tibet deter all but the most ambitious climbers.

The ascent of the highest mountains of Europe has usually been the work, however strenuous, of a day or at most two or three. In the Himalayas the effort must extend over many weeks. Only the seasoned mountain climber, after years of experience, can hope to qualify for such a feat. Every problem of mountain climbing is here encountered in a superlative degree. The British Alpine Club requires a long apprenticeship in climbing before attempts are made upon the great Asiatic peaks, which may be said to come only at the conclusion of an extended postgraduate course.

The region of the Himalayas is a land of

magnificent distances. The Alpine railroads carry the tourist to the base, even, indeed, to the foot-hills, of its famous peaks. No railroad approaches the Himalayas. The most convenient point of departure is Darjiling, from which a tramp of fifty miles or more over difficult country is required before the actual ascent is begun. There are no half-way houses or Alpine huts and shelters on the precipitous sides of the Himalayan peaks.

The first serious attempt to climb the Himalayas was not made until 1883, when an English climber, W. W. Grahm, assailed Mount Kabru. The climb was a pure adventure and had no scientific purpose. He succeeded in reaching the summit, 23,975 feet above sea-level. Even in contrast to the most ambitious efforts made since then in climbing the Himalayas, Grahm's achievement is still considered a great climb.

Kabru is curiously unfamiliar, although it rises to a great altitude, readily dominating the peaks of every other continent. The Grahm expedition of twenty, which included two imported Swiss guides and a party of coolies, started out from Darjiling. A tramp of more

than fifty miles over much swampy country and across the lower ridges of the mountains brought them to the foot of the main range. Several days were devoted to climbing the lesser peaks by way of experiment, including the ascent of Jaboni, with an altitude of 21,400 feet, itself no mean achievement.

The precipitous slopes of Kabru had all the mystery of an undiscovered country. Unlike the great alpine peaks, where every possible trail has been mapped, Kabru was an absolutely unknown quantity. A line of attack was finally decided upon. A novel experience even to these seasoned climbers was the crossing of a great glacial stream, whose ice-cold waters reached above the waste. When they approached the base of the mountain, heavy snowstorms were encountered. Pushing rapidly through the drifts, the party finally camped for the night in deep snows at an altitude of sixteen thousand feet. Many climbers have considered the ascent of peaks of less altitude the achievement of a lifetime.

Starting the next morning at dawn, the party traversed extended snow-slopes, which soon brought them to the upper faces of the moun-

tain. In many places the newly fallen snow was very deep, thus slowing down their progress. The coolies, heavily laden with provisions, naturally set the pace. The snow-slopes ended at the foot of formidable rock formations, which brought the party to a halt. On the advice of the Swiss guides, who, though strangers to the Himalayas, were at home in such high regions, the party climbed these rocks, which brought them to an elevation of nineteen thousand feet. To their dismay they now found a deep abyss separating them from the main peak, and were forced to retrace their steps.

The misadventure of one of the climbers at this point almost annihilated the entire party. He had climbed above the main body in search of a way around the abyss when he chanced to dislodge a large rock, developing an avalanche that just escaped them as it pounded down the mountain-side to a glacier more than a mile below; the morale of the natives was badly shaken by the episode. The party now returned to the foot of the rocky buttress and tried another face.

By cautious climbing the party now trav-

ersed a narrow ledge at an altitude of 18,500 feet which precariously overhung a great precipice. Here camp was pitched for the night. The final assault was made from this point early the following morning. Three men roped together now ventured on the high slopes of the mountain. Their line of approach lay across an ice-field that dipped precariously toward a six-thousand-foot precipice. Snow work under such conditions is always precarious, but the positions of the party gained an added thrill from the fact that the snow covering was loose and at a misstep might begin to slide toward the abyss, carrying them along with it.

Farther on, the snow grew harder and the footing safer. The incline increased rapidly, however, so that steps had to be cut in the surface to assure a footing. Hours of this work were required to carry the party a thousand feet, when they finally reached the top of the ridge. They now found themselves at the base of the main dome of the mountain, which still rose about fifteen hundred feet higher.

The difficulties they had overcome were trifling, however, compared with the problem that

now confronted them. The upper slopes were found to be ice-covered and, moreover, rose at an angle varying from fifty to sixty degrees. Visualize the steep side of a sixty-degree triangle and imagine it covered with smooth ice, not rugged rock, and then carry this line up for fifteen hundred feet, and you may begin to appreciate the difficulties of the problem.

The orthodox way of attacking such a slope is to cut steps laboriously up the slope. But the height of the slope rendered this quite impracticable. It chanced, however, that a snow that had recently fallen had frozen firmly upon this wall of glass-like ice. It proved to be comparatively easy to cut footholds upon this surface, which fortunately held fast. After two hours of the hardest kind of work, the party found themselves on the lower summit of the mountain at an altitude of 23,700 feet above the sea. After so brave a fight ultimate success seemed within reach. It was now discovered that a narrow ridge of ice extended to the upper summit forming the only possible means of approach.

The passage of this precarious ice-ridge presented the greatest difficulties of the entire

ascent. On either hand it sloped away sharply downward, so that a single misstep might easily prove fatal for all three. If they were to slip down one of the two faces, there was little choice between them. On one side there was a sheer descent of ten thousand feet, so that any one launched on this astonishing toboggan slide would inevitably make the entire downward trip with continually accelerating speed. On the other side the ice broke away a few feet below, overhanging a similar abyss. Further to daunt the climbers, a thick mist crept up about the mountain.

There was at least one favorable feature in the situation: the wind had fallen. Had even a moderate gale swept the slippery ice-ridge, it would have been impossible for the climbers to keep their footing. After weighing the dangers, it was decided to chance the passage of the ice-ridge. It required two full hours of desperate climbing, when the three men reached a narrow notch of ice, which forms the summit of the mountain. Even now, however, the ultimate summit was beyond them. It consisted of a hard giant icicle about fifty feet in height. Despite their best efforts, it was

found impossible to scale this formation. The party now found itself at an altitude of almost twenty-four thousand feet. A flag was raised, and a bottle containing the names of the party was left here, after which the three rejoined their main force and eventually reached the base of the mountain in safety.

Although the geographies have celebrated the supremacy of Mount Everest among all the mountains of our planet, the name of the second highest mountain is virtually unknown. Our ignorance is the more remarkable since this peak is probably the most impressive in the world and has been often assailed by climbers. The mountain, which lies in the Karakoram Himalayas, is known officially as K 2. In England it is commonly called Mount Godwin-Austen, although the name has not been officially recognized. Its altitude is placed at 28,250 feet, or about twice the height of our own Pikes Peak.

Despite its rank among the mountains of the world, the appearance of K 2 is unfamiliar. It rises abruptly from its plateau, in outline a fairly regular pyramid capped with a dome, and is suggestive of the Matterhorn

or Mount Assiniboine. The sides are creased with deep transverse valleys, which lend it a remarkable effect of ruggedness. The mountain is admirably portrayed in the photograph that forms the frontispiece of this volume.

K 2 has been assailed in vain from every side. The most ambitious attempt was made in 1900 by the Duke of the Abruzzi. Every preparation that long experience could suggest and wealth assure was made in advance. Eight picked Italian guides and a large force of coolies were engaged. Several attempts were first made to climb the lesser peaks in the vicinity. The most successful of these efforts was that directed against the Brides Peak, which has an elevation of 25,110 feet. The party succeeded in climbing to an altitude of 24,600 feet, when they were forced by bad weather to retreat. Until about ten years ago this was the world's highest climbing record. In the attack on K 2 the party in the face of great difficulties succeeded in reaching an elevation of 21,870 feet. The climb was made on the face of the mountain shown in the accompanying photograph.

It was hoped that the upper slopes of K 2

would prove less steep than they appeared from the valley below. Viewed at close range, the cone of the mountain was found to be even more formidable than was supposed. The topmost peak rises from a great sloping shoulder that is entirely covered by glaciers. The ice extends far down and menaces the ravines, furrows, and ridges of the wall below, which is surprisingly steep. The peak was found to be very sharp and to be covered with a great ice-cap or dome, which joins a formidable rock face that rises almost vertically for a great distance. This combination of ice-cap with vertical rock walls presents a baffling problem to mountain climbers.

The photograph that forms the frontispiece of this volume was taken during this expedition. The Duke's party had spent several weeks exploring the sides of the mountain, having traveled about three fourths the circumference of its base. The weather had been bad, shutting out the view of the upper slopes. A number of photographs had been taken from various points of view with more or less success. Just before turning back from the attack the photographer had at least one good

day when the mists were all cleared from the upper peaks and the sun lighted up the entire face. The light effects at the time the picture was taken were especially fortunate in throwing the rugged outline into high relief.

The photographer was fortunate in catching this unusual effect at the moment when a severe storm swept the highest peak, carrying away enormous snow-clouds in the effect of a great banner flung aloft. The picture as it stands, without retouching of any kind, is considered by many to be the finest mountain photograph ever taken.

The first tragedy in climbing the Himalayas occurred early in 1895. A famous English mountaineer, A. F. Mummery, in that year visited the peaks of Kashmir. An elevation of twenty-one thousand feet was attained on one of the lesser peaks. The feat will always rank high among such achievements, since it included some of the most formidable rock climbing work ever attempted.

An attempt was next made upon Nanga Parbat. It failed, and Mummery returned a second and a third time to the attack, but with the same result. He then decided to

cross to the northern side of the mountain, which seemed more promising. The party was divided: Mummery with two guides started out to cross the Diama Glacier by the pass of the same name, while the others took a longer and obviously safer route. The climbers were to meet at Rakiot Nullah at the side of the glacier some days later. The larger division of the party, which had followed the safer route, reached this point on schedule but saw nothing of their leader and his guides. Evidently the route he had selected had proved impossible. No trace of the missing climbers has ever been discovered. Whether they perished in some great crevasse of the glacier or fell over some mountain precipice or were overtaken by a mountain storm remains a mystery.

A new era, about this period, was opening in the history of mountain climbing: it was coming to be realized that the highest ascents among the Alps or our own mountain ranges of America are almost insignificant by comparison with the prizes to be won in the Himalayas, where are to be found scores of mountain summits twice the height of our own

Pikes Peak, and where the loftiest mountains of Europe are overtopped by ten thousand feet. Although the difficulties of attempting such conquests are naturally very great, a surprising activity in this remote region developed. The courage and persistence displayed by the early climbers who first reached the summits of Mont Blanc and the Matterhorn have, indeed, been outclassed in India in recent years.

An attempt was presently made upon the third highest peak in the world, Kunchinjinga, in the Sikhim Himalayas; it is credited with an altitude of 28,156 feet. Its summit was not reached, but the party gained an altitude of twenty-two thousand feet on Jonsong La and covered much new and unexplored country.

In 1907, during one of the most persistent efforts ever made upon the Himalayas, a party camped out on Kabru for thirteen nights with the altitude of the lowest camp for the period at 19,500 feet, and with many of them much higher. This expedition was organized by two Norwegians, C. W. Rubenson and Monrad-Aas. The climbing was done without guides but with the assistance of coolies. Base-camps were established, first at the foot

of the mountain and later at various altitudes, which were occupied by the coolies, who maintained a line of communication with those at the front. Few expeditions have been so carefully organized in this respect.

The advance was seriously checked on the lower levels by an immense ice-fall, which despite the best efforts of the numerous party could not be passed for five days. Progress was only possible after the laborious cutting of ice-steps over innumerable ice-peaks and crevasses. A second camp was later pitched at a height of twenty-two thousand feet. The thermometer indicated four degrees below zero Fahrenheit, with high winds. It was planned to scale the ridge between the two peaks, but the force of the wind made this impossible.

Taking advantage of what shelter the mountains afforded from the wind, the party reached the northeast peak. The topmost point, however, still rose about fifty feet above them. The hour was so late that it was decided not to attempt a further effort, and the descent was begun. The long steep slopes of Kabru are even more dangerous to descend than to climb. A single slip is likely to start

the unlucky climber on a downward slope free from any obstacles that may check his progress. Mr. Rubenson's first-hand description of such an adventure is sufficiently thrilling.

"On the return journey," he writes, "we had a very narrow escape. Going down a very steep slope, I, who was in the rear and roped to my companion, slipped from the icy step; we had given up nailed boots after reaching the second highest camp on account of the great cold the nails gather and communicate to the feet. I fell on my back, and flashed past my friend like a shot. He was, luckily for both of us, able to retain me by lying against the slope. The rope, a Swiss tourist rope of five strands, very nearly broke, four of these strands parting, so that I was held by a single strand. As I did not lose hold of my ax I was able to firmly reinstate myself and continued the journey down. It was marvelous Mr. Monrad Aas was able to check himself seeing the position he was in. Had we both fallen we could not possibly have survived a slide of 500 feet and then a drop on to a lower glacier."

This method of coasting or glissading down steep mountain-sides on the crest of an avalanche of course covers the distance in the least possible time, but the practice is not to be encouraged. One of the most remarkable experiences of this kind in all mountaineering was that of Dr. T. H. Longstaff while climbing Gurla Mandhata, one of the Himalayas, in Tibet; its elevation is 25,350 feet. The doctor had reached a height of about 23,000 feet when he found himself cut off from the summit and obliged to retrace a considerable part of his journey. In descending he chanced to start an avalanche, which carried him at incredible speed for more than a thousand feet past dangerous rock constructions.

By this amazing accident he now found himself in a few seconds in a position to attack another face of the mountain. He pitched camp for the night at a height of about twenty thousand feet, and the next day he succeeded in reaching an elevation of twenty-three thousand feet. The start was made by lantern at 2:30 the following morning. He ultimately reached an elevation of twenty-four thousand feet, which remains one of the greatest

achievements in the history of mountaineering. A year later Dr. Longstaff assailed another Himalayan peak, Nanda Trisul, which has an elevation of 23,406 feet. He succeeded in reaching the ultimate summit, which is a unique record in this group.

American mountain climbers have made several notable records in the Himalayas. Dr. Hunter Workman in 1903 attempted to ascend Pyramid Peak in the Baluchistan Himalayas and succeeded in ascending to an altitude of 23,394 feet. His wife, Mrs. Fanny Bullock Workman, succeeded in reaching an altitude but seven hundred feet less than this, and therefore holds at this writing the world record for the highest mountain climbing among women.

In the present stage of the development of mountain climbing, many of the peaks of the Himalayas are frankly impossible. The upper slopes are often set at angles that defy every effort to climb them, however fearless and determined. Much will be gained in the future in the way of organization. It will doubtless some day be possible to engage trained coolies in any number in India who

will be available at altitude of more than twenty thousand feet.

The day may come when the Himalayas will be as well supplied with trained guides as are the Swiss Alps or the Canadian and American Rockies to-day. Much will be gained by building substantial huts at advantageous points on the mountain slopes and by establishing continuous lines of communication between civilization at the mountain base and the upper altitudes. Future generations may enjoy such advantages, although the time seems far distant. A day may even come when hotels will be perched high up among the Himalayas as they are to-day in Switzerland and in our own West. There will still remain many peaks in this region, however, which no skill of mountain climbing may conquer. The ultimate question of the problem may lie only in the flying craft.

Some idea of the extent of the Himalayas may be gained by a comparison with other ranges. The highest mountain in Europe, Mont Blanc, rises to 15,792 feet. America's highest peak, Mount McKinley, has an elevation of 20,300 feet. The Himalayas include a

forest of mountain peaks that completely outclass all rival ranges. They include literally thousands of peaks over twenty thousand feet in altitude, and hundreds rising over twenty-three thousand feet. While vast regions still remain to be explored, official surveys have established the existence of about 150 peaks above twenty-four thousand feet in height, as follows:

75	mountains	over	24,000	feet
48	"	"	25,000	"
16	"	"	26,000	"
5	"	"	27,000	"
3	"	"	28,000	"

CHAPTER XVI

THE CONQUEST OF MOUNT EVEREST

IN India Everest is known as Chomolungina; this name, literally the "Goddess Mother of the Snows," would be hard to mend. When the highest of all mountains was discovered in recent years by an Englishman, Colonel Everest, it took his name. Few Europeans have actually seen its ultimate peak. It lies more than one hundred miles from the nearest settlement. Its extreme remoteness and the astonishing difficulties that guard its upper slopes lend it a remarkable fascination.

Mount Everest is the ultimate goal of mountain climbers. The art of mountaineering has in a sense been developed to fit men for this final conquest. So long as its summit remains unconquered, the skill and endurance of the race of mountaineers will not have won their final victory. The ascent of Everest is the last supreme effort. In the long dramatic

history of mountain climbing no expeditions have ever been organized with more patience and skill than those directed against Everest. A fortune has been spent and years of effort bestowed merely on the preliminary survey to determine the best approach. The sturdiest and most experienced mountain climbers in the world, fresh from victories in other lands, have been recruited for the attack.

The mountaineer who first steps upon the ultimate summit of Mount Everest will gain world-wide fame. His name will become a household word and will be remembered for centuries to come. The conqueror of this peak may contribute much to the world's knowledge. The supreme ambition of all mountain climbing will be realized. Here is reward enough to lure many expeditions from the ends of the world.

The Everest expeditions have brought back observations of great scientific value. On the first attempt an important geological survey was completed, and both expeditions collected many specimens, both geological and botanical, from altitudes never before visited. The geologists are especially anxious to secure a stone

from the topmost point of Mount Everest. There has been an immense amount of theorizing about the formation of the highest mountain, and opinion is divided as to whether the utmost peak is the bottom or the top of a fold. A stone brought from this spot will definitely decide the controversy and make it possible to determine the history of the highest of mountains.

The question naturally arises as to the insistence of the surveyors of Mount Everest on adding two feet to the very round number of 29,000. Since the surveys have been made from points one hundred miles or more from the peak, the apparent accuracy of these figures seems fantastic. As a matter of fact, about twelve different observations have been made to determine the elevation of Mount Everest. The first was taken as early as 1849, and the last in 1902. There has been considerable variation in these calculations, and the figures now generally accepted have been determined by the simple expedient of adding twelve different observations together and dividing the sum by twelve. Some observers favor the figure of 29,141 feet. When the top is finally

reached and the boiling-test is applied, all discussions will end.

Some doubts have been raised as to Mount Everest's actual supremacy among the mountains of the world. Several explorers who have reached the higher altitudes of neighboring mountains have gained the impression that Everest was overtopped by other peaks. When Grahm climbed Kabru and found himself at an elevation of 24,015 feet Mount Everest lay but seventy miles away, and from this vantage-point there appeared to be two higher peaks. Similar observations have been made by Sir Joseph Hooker during his journeys in this wilderness of great mountains. Everest is believed by some to have several rivals. The observations made from its summit will definitely decide the question for all time.

Can Everest be climbed? The leaders of the great expeditions, after a preliminary survey made through one year and a supreme effort in the final attack the next year, frankly confess themselves in doubt. The difficulties are overwhelming. On the return from the last unsuccessful attempt in 1922 one of the

party, G. Leight Mallory, discussed the problem in detail before the Alpine Club.

One of the great difficulties, he explained, is to secure helpers who can work effectively at an altitude of more than twenty thousand feet. It is necessary to carry all necessary supplies to these remote heights. The men secured for the great effort proved to be devoted to their task and willing to chance their lives in the attempt, but a place was reached where the effort was beyond human endurance. The narrative of the final drive is very convincing.

The first problem, according to Mr. Mallory, is to establish a camp below the north col. The reconnaissance made a year before the final drive showed that this could be done. It is exceedingly difficult to find porters who can start out afresh from such an altitude. Nevertheless in the final effort the party started upward from their camp at the twenty-one-thousand-foot altitude with the porters in good condition.

The great problem lies in covering the ground between twenty-one thousand and twenty-nine thousand feet. A way was discovered to reach the north col, although the

MT. STEPHENS, CANADIAN ROCKIES

[The Town of Field, B. C., and Canadian Pacific Railroad in Foreground]

PARADISE VALLEY, CANADIAN ROCKIES

difficulties encountered were like those of facing a terrific storm at sea. Above this point no insurmountable difficulties were discovered below the final ridge. From the preliminary survey it seemed within human possibilities that this could be reached. Experience showed that men could exist at this altitude, to which no human being had before climbed. The final failure in 1922 may be attributed to the fact that the supreme effort must be made by men at the end of days of struggle and severe nerve-strain.

If all goes well and the plans made in advance can be carried out, the ultimate peak of Everest may be reached. There are many variable factors to be considered, however. The upper slopes, which appeared possible to the exploring party of 1921, had changed in the year that intervened before the final effort. The route selected in one place was suddenly rendered impossible by a crevasse that no human effort could pass.

At a critical point several of the porters succumbed to mountain sickness. Another unexpected difficulty was faced on approaching the top, when it was discovered that the snow-

slope of the previous year had disappeared. And to all these difficulties must be added baffling weather conditions.

The snows of these regions, again, are overwhelming. The seasoned snow climber who has faced these problems in the Alps or the Rockies for years often finds himself completely baffled on the slopes of the Himalayas. One of the attempts upon Mt. Everest was brought to a standstill and finally turned back by a snowstorm. The party had spent eight weeks in arduous climbing at an altitude of more than twenty thousand feet when the snow began to fall. In this region there is but one month in the year that is reasonably free from blizzards. In the storm in question, snow fell continuously for 114 hours without interruption. It then stopped, but only for a period of twenty minutes, when it began again, this time in real earnest, and continued for another one hundred hours. When the weather finally cleared, the snow was twenty-five feet deep on the level.

With such material, the avalanches of the Himalayas are naturally on a gigantic scale. When a twenty-foot snowfall is started down

a precipice thousands of feet in depth, enormous areas are endangered. The great sweep of these avalanches is shown in several of the accompanying photographs.

The conquest of Mount Everest was first planned about forty years ago. For years a group of enthusiasts known as the Mount Everest Committee of the Royal Geographical Society has been more or less actively furthering the enterprise. The supreme effort was not planned, however, until 1920, when an elaborate expedition was sent out from Darjiling to reconnoiter the ground and plan the final assault. The preliminary expedition alone cost about thirty thousand dollars, and it reached an altitude of 22,300 feet. The final dash for the summit made in the following year cost fifty-five thousand dollars and reached an altitude of 27,300 feet, the highest point ever reached by mountain climbers. It has been announced that still another expedition will attack Mount Everest in 1924.

Mount Everest hides behind many other formidable mountains, and its remote position presents baffling difficulties. One of the first problems in organizing the attack was to secure

permission from his Holiness the Dalai Lama of Tibet to enter the region; permission was freely granted. The expedition assembled at Darjiling early in May, 1921, and included forty coolies, four cooks, an interpreter, and nine Europeans. A stretch of more than one hundred miles of rough country had first to be traversed on foot before Mount Everest was reached.

The party left Darjiling on May 18, and soon passed the outposts of civilization. The early stages of the climb were enlivened by a threatened mutiny of the coolies. An entirely unknown country was now entered. A few scattered native villages were passed, where the expedition was made welcome. Even the natives of the region, it was found, knew surprisingly little about Mount Everest, whose great peak looked down upon them. They believed that a wide valley lay to the south of the mountain, but had no definite information.

The party now made their way with great difficulty through an intricate country of glaciers. It was found impossible to attack Everest from the Kama valley, as had been planned. Several valleys were now explored,

and one was finally selected which apparently led directly to the great snow peak. A gentle snow-slope stretched invitingly ahead, and the party had no difficulty in reaching an altitude of twenty-one thousand feet, when a sharp ridge barred their progress. The summit of Everest now rose directly above them about eight thousand feet beyond.

An attempt was made to ascend by a direct attack. The snow was found to be in bad condition, and the angle of ascent soon became impossible. A glacier was now crossed on snow-shoes, and a camp was established at an altitude of twenty thousand feet. From here an ascent was made to an elevation of 22,300. The party fought their way up the mountain face despite enormous difficulties, and finally reached a point where the great face of Everest could be studied in detail.

A formidable expanse of rock and snow lay above them. To the critical eyes of the climbers the face looked passable. Under favorable conditions a seasoned mountain climber properly equipped might attack such a slope with chance of success. During the party's stay in this region, however, the pre-

cipitous slope was swept by winds of hurricane force. One of the party, Lieutenant-Colonel C. K. Howard-Bury, later described his impression in detail before the Alpine Club.

"Even where we stood," he said, "under the lee of a little ice-cliff the wind came in fierce gusts at frequent intervals, blowing up the powdery snow in a suffocating *tourbillon*. On the col behind it was blowing a gale. And higher up was a more dreadful sight. The powdery snow on the great face of Everest was being swept along in unbroken spindrift, and the very route where our proposed path lay was marked out to receive its unmitigated fury. We could see the snow deflected upward for a moment where the wind met the ridge, only to rush violently down in a frightful blizzard on the leeward side.

"To see, in fact was, enough; the wind had settled the question; it would be folly to go on. We struggled a few steps further to put the matter to the test. For a moment we exposed ourselves on the col to the full strength of the blast, then struggled back to shelter. Nothing more was said about pushing the assault further."

The party descended Everest and returned to Darjiling, and went thence to England to prepare for the exploration of the following year.

The final dash for the summit of Everest is in many respects the most dramatic experience in the history of mountain climbing. No expedition has probably ever been organized with such lavish attention. The most expert climbers in the world journeyed to India to make the effort. The preliminary survey made the year before, it was hoped, had anticipated every difficulty. Every assistance that could be lent by the Government had been assured. The final dash was the supreme effort of the world's best talent in mountain climbing after years of preparation.

A regiment of porters and assistant helpers started out from the plains for the final attack. A series of camps were established at various stages, and a mere handful survived the long climb. The account of this last stage of the famous attack was furnished by Mr. George L. Finch to the Alpine Club. The final effort was made from the famous Camp at 25,500 feet elevation, the last of the camps established

on the slopes of Everest. An unforeseen difficulty had delayed the party here when one of the cylinders in which the supply of oxygen was being carried sprang a leak. In climbing to these unknown regions it was essential that the men should take with them even the air they breathed. In the intense cold, far below zero, the men had to remove their gloves and handle the cold metal of the tanks and the tools. The work was finally completed.

It was hoped that a camp could be pitched higher than twenty-six thousand feet, which would be the final resting-place of the party before the last desperate dash for the top. The weather had so far been fairly good, but now the wind increased and it began to snow. The conditions grew rapidly more threatening, and the party was well satisfied to pitch camp under twenty-six thousand feet. It had the distinction of being the highest habitation, however temporary, ever established by man.

It was planned to climb still farther, but the storm checked the advance. The party was obliged to make the best of a very perilous position. The slope was so steep that they had to content themselves with leveling a little

platform in the ice and snow. Only the slightest protection was thus gained against the storm. The camp rested precariously on the edge of a precipice four thousand feet in depth. The weather grew bitterly cold.

A frightful night followed. The hurricane force of the wind tore at the frail tent, so that every one had to hold on to the sides literally for dear life. Sleep was out of the question. None of the party dared relax for fear that the battle might go against them. In Mr. Finch's words, "We fought for our lives. If the wind won the struggle, we would all go down the glacier." The gale reached its height at one o'clock. For hours the cold was so intense and the wind so baffling that no one could face it outside the tent for more than three or four minutes at a time. Each asked himself the question how much longer human beings could stand such a strain.

The morning came bleak and cold. A spirit-lamp was lighted to warm food, but the draft blew the flame about so that the tent was endangered. And this frail shelter, it was realized, was for them the only barrier between life and death. A flying stone descending the

mountain had cut a hole in the tent, which made the situation still more desperate. The snow sifted in, completely covering every one. The storm now abated somewhat, but it was impossible to face it. The party was desperately tempted to retreat. It seemed suicidal to remain in such a position for another hour, but after consultation they literally threw their lives in the balance and decided to try for another day.

The hours dragged wearily, and night again set in. During a lull in the wind the party was startled by the sound of human voices outside the tent. It proved to be some of the guides, who had been left at the last camp and braved the storm to come with assistance. They brought with them a supply of hot food and hot drinks in vacuum-bottles. One of the discomforts of the twenty-six-thousand foot camp was that no really hot drinks could be prepared. At this altitude water boiled at so low a temperature that the climbers could put their hands in it without scalding, and really hot drinks were impossible.

The night began critically. For hours without sleep, the diminished company had to con-

tinue their hand-to-hand battle with the gale. All were exhausted by the long struggle and lack of nourishment. From time to time the oxygen-tank was passed around, and each in turn took the stimulant. The guides heretofore had scorned oxygen, which they called "English air" and distrusted. In this extremity they inhaled it, and as each in turn felt the relief of the life-giving oxygen in his lungs, his face brightened and new hope was revived.

The party was afoot at daybreak with every muscle and nerve on the strain for the last desperate dash for the summit. But the strain of the two nights had left its effect. The men literally trembled from fatigue and hunger. Several of the party found that their boots had been frozen, and an hour was lost while they tried to shape them over the flame of a lighted candle. Finally the start was made.

At a trifle over twenty-six thousand feet the guides collapsed. The natives, whose lives had been spent on the lower hills, had reached the limit of their endurance. They were sent back to the camp, and the diminished company pushed on. With a supreme effort they gained 26,500 feet. And now the wind began to rise

still higher, carrying great clouds of shifting snow. In the face of this, the party continued to work their way laboriously up the face of the ultimate peak. They climbed without ropes, taking a desperate chance, in the hope that they could make better time. The aneroid barometer indicated twenty-seven thousand feet.

It was decided that an effort be made for a point on the northwest ridge known to be 27,300 feet up. The highest mountain now visible was Cho Uyo, which has an elevation of 27,000 feet. Its summit appeared to be below them. The goal was at last in sight. Just before them rose the highest peak of Everest. They were so close that they could distinguish individual stones on a little patch of screen lying just beneath the highest peak.

Let Mr. Finch describe the sufferings mental and physical of the next few minutes. "Ours were truly the tortures of Tantalus," he writes. "Weak with hunger and exhausted by the nightmare struggle for life in our high camp, we were in no fit condition to proceed. Indeed, I know that if we were to persist in climbing on, if only for another five hundred feet, we

should not get back alive." Three of the party had reached an altitude of 27,300 feet, the highest point ever attained. The survivors turned to face the dangers of the long descent. Above them, serene, unconquered, rose the summit of the "Goddess Mother of the Snows."

BIBLIOGRAPHY

"Alpine Journal," The Alpine Club.

"Canadian Alpine Journal," The Alpine Club of Canada.

"Climbers' Guide to the Rocky Mountains of Canada," American Alpine Club.

"Mountain Adventures at Home and Abroad," C. D. Abrahams.

"Swiss Mountain Climbs," C. D. Abrahams.

"Alpine Adventures," W. H. D. Adams.

"Chamouni and Mont Blanc," Eustace Adams.

"Hints and Notes for Travel in the Alps," John Ball.

"The Conquest of Mount McKinley," Belmore Browne.

"Transcaucasia and Ararat," James Bryce.

"Among the Canadian Alps," L. J. Burpee.

"Mountaineering in Colorado," Frederick H. Chapin.

"Mountain Peaks of Colorado," Colorado Mountain Clubs.

"Mountain Memories," Sir Martin Conway.

"The Alps from End to End," Sir Martin Conway.

"Aconcagua and Tierra del Fuego," Sir Martin Conway.

"Pioneers of the Alps," C. D. Cunningham and W. de W. Abney.

"The Ascent of Mount St. Elias," the Duke of the Abruzzi.

"Karakoram and Western Himalaya," the Duke of the Abruzzi.

"Ruwenzori: an Account of the Expedition of the Duke of the Abruzzi."

"Handbook of Yellowstone National Park," A. F. Hall.

"Mount Everest: The Reconnaissance," Lieutenant-Colonel C. K. Howard-Bury.

"Call of the Mountains," Le Roy Jeffers.

"Adventures in the Alps," A. C. Knowles.

"Explorations of the Alps," A. H. M. Lunn.

"The Annals of Mont Blanc," C. E. Mathews.

"Mount Rainier," F. E. Mathews.

"Mount Rainier," E. S. Meany.

"Mountain Climbs in the Alps and Caucasus," A. F. Mummery.

"Stories of Alpine Adventures," F. Mundell.

"Mountaineering Art," Howard Reaburn.

"My Climbing Adventures in Four Continents," Samuel Turner.

"Siberia: A Record of Climbing, Travel, and Exploration," Samuel Turner.

"Hours of Exercise in the Alps," Samuel Turner.

"Scrambles among the Alps," Edward Whymper.

"The Ascent of the Matterhorn," Edward Whymper.

"Travels among the Great Andes of the Equator," Edward Whymper.

"Alpine Ascents and Adventures," H. S. Wilson.

"The Call of the Snowy Hispar," W. H. and Mrs. F. B. Workman.

"Mountain Craft," C. W. Young.

"Book of the National Park," Robert S. Yard.

"From the Alps to the Andes," Mattias Zurbriggen.

ASSOCIATED MOUNTAINEERING CLUBS OF NORTH AMERICA

Adirondack Mountain Club, Albany.

American Alpine Club, Philadelphia and New York.

American Civic Association, Washington.

American Forestry Association, Washington.

American Game Protective and Propagation Association, New York.

American Museum of Natural History, New York.

American Nature Association, Washington.

American Scenic and Historic Preservation Society, New York.

Appalachian Mountain Club, Boston and New York.

Black Hawk Hiking Club, Rock Island, Illinois, and Davenport, Iowa.

Boone and Crocket Club, New York.

British Columbia Mountaineering Club, Vancouver.

Buffalo Society of Natural Sciences, Buffalo.

California Academy of Sciences, San Francisco.

California Alpine Club, San Francisco.

Camp and Trail Club, Lake Placid Club, New York.

Camp Directors Association of America, New York.

Canadian National Parks, Department of the Interior, Ottawa.

Cascadians, Yakima, Washington.

Colorado Mountain Club, Denver.

Coöperative Campers, Seattle.

Explorers Club of Mexico, Mexico, D. F.

Field and Forest Club, Boston.

Fresh Air Club, New York.

Geographic Society of Chicago.

Geographic Society of Philadelphia.

Green Mountain Club, Inc., Rutland, Vermont.

Inkowa Club, New York.

Klahhane Club, Port Angeles, Washington.

Mazamas, Portland, Oregon.

Mountaineers, Seattle and Tacoma.

Mount Stuart Club, Ellensburg, Washington.

National Association of Audubon Societies, New York.

National Forestry Program Committee, New York.

National Park Service, Department of the Interior, Washington.

National Parks Association, Washington.

National Parks Committee, New York.

New York State College of Forestry, Syracuse.

New York Zoölogical Society, New York.

Olympians, Hoquiam, Washington.

Omaha Walking Club, Omaha.

Palisades Interstate Park Commission, New York.

Pennsylvania Alpine Club, Altoona.

Prairie Club, Chicago.

Rocky Mountain Climbers Club, Boulder, Colorado.

Sagebrush and Pine Club, Yakima, Washington.

Save the Redwoods League, Berkeley, California.

Sierra Club, San Francisco and Los Angeles.

Society for Preservation of Native New England Plants, Boston.

Spokane Mountaineer Club, Spokane.

Trails Club of Oregon, Portland.

Tramp and Trail Club, New York.

Travel Club of America, New York.

Washington Natural Parks Association, Seattle.

Wild Flower Preservation Society of America, New York.

THE END